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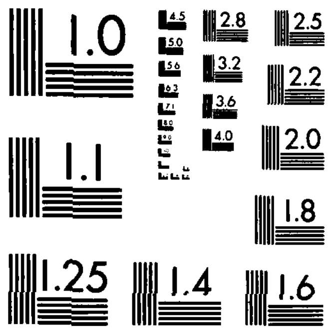

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COMPARISON OF THE ESTIMATED ITEM PARAMETERS OF SHIBA'S WORD/PHRASE COMPREHENSION TESTS OBTAINED BY LOGIST 5 AND THOSE BY THE TETRACHORIC METHOD

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ABSTRACT

Stimulated by Lord's suggestion that Logist 5 can be used for equating even when the number of linking items is small, it was tested on Shiba's Word/Phrase Comprehension Test data. Combinations of four tests and two tests, and also a single test with different numbers of examinees, were chosen, for which Logist 5 was applied. The resultant estimated item parameters were compared with those obtained by the tetrachoric method. Some consistency was found in the results of certain tests in preference to those of certain other tests.

The research was conducted at the principal investigator's laboratory, 405 Austin Peay Hall, Department of Psychology, University of Tennessee, Knoxville, Tennessee. Those who worked for her as assistants include Paul S. Changas, Lisa Lambert, Richard Strouse, and Alecia P. Long

I. Introduction

In applying latent trait theory, or item response theory, perhaps two of the most frequently used models for binary test items are Rasch model (Rasch, 1960) and three-parameter logistic model (Birnbaum, 1968). In particular, three-parameter logistic model has become more and more popular in the past decade because of the availability of computer programs for estimating the three item parameters which are represented by Logist 5 (Wingersky, Barton and Lord, 1982).

This computer program, Logist 5, can be used not only for the item parameter estimation in the three-parameter logistic model, but also in the (two-parameter) logistic model, by setting the third parameter equal to zero. It is well known (Birnbaum, 1968) that (two-parameter) logistic model provides us with a good approximation to the normal ogive model if we set the scaling factor D equal to 1.7 .

In the present study, using empirical data for which normal ogive model was originally assumed, comparison was made between the estimated item parameters obtained by assuming the normal ogive model and those obtained by Logist 5 assuming the (two-parameter) logistic model. In some cases, item parameter estimation was also made by Logist 5 assuming the three-parameter logistic model, and comparison was extended to those results also.

Empirical data adopted here were taken from the test data provided by the courtesy of Professor Sukeyori Shiba of the University of Tokyo. They are based upon the performance of fifth through ninth

graders in Japan who took separate tests of Shiba's Word/Phrase Comprehension Tests.*

II. Three-Parameter Logistic Model and Logist 5

Let θ be the latent trait, or ability, and $P_g(\theta)$ be the item characteristic function of the multiple-choice test item g, or the conditional probability with which the examinee answers item g correctly, given ability θ. In the three-parameter logistic model, this item characteristic function is given by

$$(2.1) \qquad P_g(\theta) = c_g + (1-c_g)\,\Psi_g(\theta) \quad ,$$

where $\Psi_g(\theta)$ is the item characteristic function in the (two-parameter) logistic model, for which we can write

$$(2.2) \qquad \Psi_g(\theta) = [1 + \exp\{-Da_g(\theta-b_g)\}]^{-1} \quad ,$$

with a_g (> 0) and b_g as the item discrimination and difficulty parameters, respectively, and D as the scaling factor which is usually set equal to 1.7. The third parameter, c_g, in (2.1) is the guessing parameter, which is originally defined as unity divided by the number of alternative answers presented with the multiple-

* The author is obliged to Dr. Hiroyuki Noguchi of Tokyo Gakugei University as well as Professor Shiba for providing her with these data.

choice test item g. The model was originated from the assumption that the examinee either knows the answer to the question, or guesses randomly. Thus $P_g(\theta)$, or the operating characteristic of the binary item score $u_g = 1$, given θ, is greater than $\Psi_g(\theta)$, which represents the conditional probability for the "knowledge." The discrepancy between the two functions is also a function of θ, i.e., $[1 - \Psi_g(\theta)]$ divided by the number of alternatives.

Lord started calling this third parameter, c_g, pseudo-guessing parameter, after he had discovered that for many multiple-choice test items the estimated guessing parameter, c_g, substantially differs from unity divided by the number of alternatives, when the three-parameter logistic model was adopted for those items (Lord, 1968). This fact itself seems to be enough evidence to invalidate the three-parameter logistic model with respect to those specific multiple-choice test items. Researchers who adopt this model claim, however, that there should not be any harm as long as the curve is used as an approximation to the true item characteristic function.

It should be noted that Samejima has pointed out (Samejima, 1973) that, unlike the normal ogive and the logistic models, three-parameter logistic model does not satisfy the unique maximum condition (Samejima, 1969, 1972), which indicates that for some response patterns the likelihood function $L_V(\theta)$, i.e., the operating characteristic of the response pattern, V, may not have a unique maximum. This fact implies that the third parameter, c_g, can be a

real nuisance, in the mathematical aspect of theory.

The item characteristic function in the normal ogive model is given by

$$(2.3) \qquad \Phi_g(\theta) = (2\pi)^{-1/2} \int_{-\infty}^{a_g(\theta-b_g)} \exp(-t^2/2)\, dt \quad ,$$

where a_g (> 0) and b_g are the item discrimination and the item difficulty parameters, respectively. When the same values of parameters a_g and b_g are used in (2.2) with $D = 1.7$, the curve represented by (2.2) is very close to the one represented by (2.3) for the entire range of θ (Birnbaum, 1968).

Logist 5 is a computer program developed by Lord and others (Wingersky, Barton and Lord, 1982) for the purpose of estimating the item discrimination parameter a_g , the item difficulty parameter b_g and the guessing parameter c_g of each test item g $(=1,2,\ldots,n)$ following the three-parameter logistic model, as well as the individual ability parameter θ_s of each examinee s $(=1,2,\ldots,N)$. The method is based upon the maximum likelihood estimation, with the likelihood function,

$$(2.4) \qquad L(U|\Theta,A,B,C) = \prod_{s=1}^{N} \prod_{g=1}^{n} P_g(\theta_s)^{u_{gs}} \{1-P_g(\theta_s)\}^{1-u_{gs}} ,$$

where u_{gs} is a binary item score of the examinee s for item g , U is an $(n\mathrm{x}N)$ matrix of the binary item scores u_{gs} , Θ is the vector of order N of the individual parameter θ_s , A , B and C

are the vectors of order n of the item parameters a_g , b_g and c_g , respectively. Those (3n+N) parameters are estimated iteratively through the four sets of likelihood equations, with programming devices for efficiency in their convergence.

III. Empirical Data Based upon Shiba's Word/Phrase Comprehension Tests

Shiba's research on the measurement of word/phrase comprehension has been introduced earlier (Samejima, 1980). The battery of tests used for the construction of Shiba's word/phrase comprehension scale consists of thirteen tests, AP1, AP2, A1, A2, A3, A4, A5, A6, J1, J2, S1, S2 and U. Each of these thirteen tests contains thirty to sixty multiple-choice items, each of which has a set of five alternatives. These tests differ in difficulty, and each is designed for a different age group of subjects, ranging from four years of age to the ages of college students. There are subsets of items included in two tests, which are adjacent to each other in difficulty. For example, items 37 through 56 of Test J1 are also items 1 through 20 of Test J2. There are 480 test items in total, and their participation in different tests are shown in Table 3-1. The number of examinees used for the ability scale construction varies between 219 preschoolers for Test AP1 and 924 second graders of senior high schools for Test S1.

In the present study, four tests were chosen out of these thirteen tests, i.e., A5, A6, J1 and J2. The examinees who took these four tests in Shiba's original data are as follows.

TABLE 3-1

Distribution of the 480 Test Items of Shiba's Word/Phrase Comprehension Item Pool among Thirteen Different Tests.

Item No.	Tests												
	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
1	1	0	0	0	0	0	0	0	0	0	0	0	0
2.	2	0	0	0	0	0	0	0	0	0	0	0	0
3	3	0	0	0	0	0	0	0	0	0	0	0	0
4	4	0	0	0	0	0	0	0	0	0	0	0	0
5	5	0	0	0	0	0	0	0	0	0	0	0	0
6	6	0	0	0	0	0	0	0	0	0	0	0	0
7	7	0	0	0	0	0	0	0	0	0	0	0	0
8	8	0	0	0	0	0	0	0	0	0	0	0	0
9	9	0	0	0	0	0	0	0	0	0	0	0	0
10	10	0	0	0	0	0	0	0	0	0	0	0	0
11	11	0	1	0	0	0	0	0	0	0	0	0	0
12	12	0	0	0	0	0	0	0	0	0	0	0	0
13	13	0	0	0	0	0	0	0	0	0	0	0	0
14	14	0	3	0	0	0	0	0	0	0	0	0	0
15	15	0	0	0	0	0	0	0	0	0	0	0	0
16	16	0	0	0	0	0	0	0	0	0	0	0	0
17	17	0	0	0	0	0	0	0	0	0	0	0	0
18	18	0	0	0	0	0	0	0	0	0	0	0	0
19	19	0	0	0	0	0	0	0	0	0	0	0	0
20	20	0	0	0	0	0	0	0	0	0	0	0	0
21	21	1	0	0	0	0	0	0	0	0	0	0	0
22	22	2	12	2	0	0	0	0	0	0	0	0	0
23	23	3	0	0	0	0	0	0	0	0	0	0	0
24	24	4	14	4	0	0	0	0	0	0	0	0	0
25	25	5	15	5	0	0	0	0	0	0	0	0	0
26	26	6	0	0	0	0	0	0	0	0	0	0	0
27	27	7	7	0	0	0	0	0	0	0	0	0	0
28	28	8	0	0	0	0	0	0	0	0	0	0	0
29	29	9	4	0	0	0	0	0	0	0	0	0	0
30	30	10	0	0	0	0	0	0	0	0	0	0	0
31	0	11	8	0	0	0	0	0	0	0	0	0	0
32	0	12	0	0	0	0	0	0	0	0	0	0	0
33	0	13	0	0	0	0	0	0	0	0	0	0	0
34	0	14	0	0	0	0	0	0	0	0	0	0	0
35	0	15	0	0	0	0	0	0	0	0	0	0	0
36	0	16	0	0	0	0	0	0	0	0	0	0	0
37	0	17	0	0	0	0	0	0	0	0	0	0	0
38	0	18	18	8	0	0	0	0	0	0	0	0	0
39	0	19	10	0	0	0	0	0	0	0	0	0	0
40	0	20	0	0	0	0	0	0	0	0	0	0	0
41	0	21	0	0	0	0	0	0	0	0	0	0	0
42	0	22	0	0	0	0	0	0	0	0	0	0	0
43	0	23	0	0	0	0	0	0	0	0	0	0	0
44	0	24	0	0	0	0	0	0	0	0	0	0	0
45	0	25	0	0	0	0	0	0	0	0	0	0	0
46	0	26	0	0	0	0	0	0	0	0	0	0	0
47	0	27	0	0	0	0	0	0	0	0	0	0	0
48	0	28	0	0	0	0	0	0	0	0	0	0	0
49	0	29	0	0	0	0	0	0	0	0	0	0	0
50	0	30	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	2	0	0	0	0	0	0	0	0	0	0
55	0	0	5	0	0	0	0	0	0	0	0	0	0
56	0	0	6	0	0	0	0	0	0	0	0	0	0
57	0	0	9	0	0	0	0	0	0	0	0	0	0
58	0	0	11	1	0	0	0	0	0	0	0	0	0
59	0	0	13	3	0	0	0	0	0	0	0	0	0
60	0	0	16	6	0	0	0	0	0	0	0	0	0
61	0	0	17	7	0	0	0	0	0	0	0	0	0
62	0	0	[illegible]	9	0	0	0	0	0	0	0	0	0
63	0	0	20	10	0	0	0	0	0	0	0	0	0

TABLE 3-1 (Continued)

Item No.	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
	Tests												
64	0	0	21	0	0	0	0	0	0	0	0	0	0
65	0	0	22	0	0	0	0	0	0	0	0	0	0
66	0	0	23	0	0	0	0	0	0	0	0	0	0
67	0	0	24	0	0	0	0	0	0	0	0	0	0
68	0	0	25	0	0	0	0	0	0	0	0	0	0
69	0	0	26	0	0	0	0	0	0	0	0	0	0
70	0	0	27	0	0	0	0	0	0	0	0	0	0
71	0	0	28	0	0	0	0	0	0	0	0	0	0
72	0	0	29	0	0	0	0	0	0	0	0	0	0
73	0	0	30	0	0	0	0	0	0	0	0	0	0
74	0	0	31	0	0	0	0	0	0	0	0	0	0
75	0	0	32	0	0	0	0	0	0	0	0	0	0
76	0	0	33	0	0	0	0	0	0	0	0	0	0
77	0	0	34	0	0	0	0	0	0	0	0	0	0
78	0	0	35	0	0	0	0	0	0	0	0	0	0
79	0	0	36	0	0	0	0	0	0	0	0	0	0
80	0	0	0	11	1	0	0	0	0	0	0	0	0
81	0	0	0	12	2	0	0	0	0	0	0	0	0
82	0	0	0	13	3	0	0	0	0	0	0	0	0
83	0	0	0	14	4	0	0	0	0	0	0	0	0
84	0	0	0	15	5	0	0	0	0	0	0	0	0
85	0	0	0	16	6	0	0	0	0	0	0	0	0
86	0	0	0	17	7	0	0	0	0	0	0	0	0
87	0	0	0	18	8	0	0	0	0	0	0	0	0
88	0	0	0	19	0	0	0	0	0	0	0	0	0
89	0	0	0	20	0	0	0	0	0	0	0	0	0
90	0	0	0	21	0	0	0	0	0	0	0	0	0
91	0	0	0	22	0	0	0	0	0	0	0	0	0
92	0	0	0	23	0	0	0	0	0	0	0	0	0
93	0	0	0	24	0	0	0	0	0	0	0	0	0
94	0	0	0	25	0	0	0	0	0	0	0	0	0
95	0	0	0	26	0	0	0	0	0	0	0	0	0
96	0	0	0	27	33	0	0	0	0	0	0	0	0
97	0	0	0	28	34	0	0	0	0	0	0	0	0
98	0	0	0	29	35	0	0	0	0	0	0	0	0
99	0	0	0	30	36	0	0	0	0	0	0	0	0
100	0	0	0	31	37	0	0	0	0	0	0	0	0
101	0	0	0	32	38	0	0	0	0	0	0	0	0
102	0	0	0	33	39	0	0	0	0	0	0	0	0
103	0	0	0	34	40	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0
106	0	0	0	0	0	0	0	0	0	0	0	0	0
107	0	0	0	0	0	0	0	0	0	0	0	0	0
108	0	0	0	0	0	0	0	0	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0
112	0	0	0	0	0	0	0	0	0	0	0	0	0
113	0	0	0	0	0	0	0	0	0	0	0	0	0
114	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0
116	0	0	0	0	0	0	0	0	0	0	0	0	0
117	0	0	0	0	0	0	0	0	0	0	0	0	0
118	0	0	0	0	0	0	0	0	0	0	0	0	0
119	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0
121	0	0	0	0	9	0	0	0	0	0	0	0	0
122	0	0	0	0	10	0	0	0	0	0	0	0	0
123	0	0	0	0	11	0	0	0	0	0	0	0	0
124	0	0	0	0	12	0	0	0	0	0	0	0	0
125	0	0	0	0	13	0	0	0	0	0	0	0	0
126	0	0	0	0	14	0	0	0	0	0	0	0	0
127	0	0	0	0	15	0	0	0	0	0	0	0	0
128	0	0	0	0	16	0	0	0	0	0	0	0	0
129	0	0	0	0	17	0	0	0	0	0	0	0	0

TABLE 3-1 (Continued)

Item No.	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
	Tests												
130	0	0	0	0	18	0	0	0	0	0	0	0	0
131	0	0	0	0	19	0	0	0	0	0	0	0	0
132	0	0	0	0	20	0	0	0	0	0	0	0	0
133	0	0	0	0	21	0	0	0	0	0	0	0	0
134	0	0	0	0	22	0	0	0	0	0	0	0	0
135	0	0	0	0	23	0	0	0	0	0	0	0	0
136	0	0	0	0	24	0	0	0	0	0	0	0	0
137	0	0	0	0	25	1	0	0	0	0	0	0	0
138	0	0	0	0	26	2	0	0	0	0	0	0	0
139	0	0	0	0	27	3	0	0	0	0	0	0	0
140	0	0	0	0	28	4	0	0	0	0	0	0	0
141	0	0	0	0	29	5	0	0	0	0	0	0	0
142	0	0	0	0	30	6	0	0	0	0	0	0	0
143	0	0	0	0	31	7	0	0	0	0	0	0	0
144	0	0	0	0	32	8	0	0	0	0	0	0	0
145	0	0	0	0	0	9	0	0	0	0	0	0	0
146	0	0	0	0	0	10	0	0	0	0	0	0	0
147	0	0	0	0	0	11	0	0	0	0	0	0	0
148	0	0	0	0	0	12	0	0	0	0	0	0	0
149	0	0	0	0	0	13	0	0	0	0	0	0	0
150	0	0	0	0	0	14	0	0	0	0	0	0	0
151	0	0	0	0	0	15	0	0	0	0	0	0	0
152	0	0	0	0	0	16	0	0	0	0	0	0	0
153	0	0	0	0	0	17	0	0	0	0	0	0	0
154	0	0	0	0	0	18	0	0	0	0	0	0	0
155	0	0	0	0	0	19	0	0	0	0	0	0	0
156	0	0	0	0	0	20	0	0	0	0	0	0	0
157	0	0	0	0	0	21	0	0	0	0	0	0	0
158	0	0	0	0	0	22	0	0	0	0	0	0	0
159	0	0	0	0	0	23	0	0	0	0	0	0	0
160	0	0	0	0	0	24	0	0	0	0	0	0	0
161	0	0	0	0	0	25	1	0	0	0	0	0	0
162	0	0	0	0	0	26	2	0	0	0	0	0	0
163	0	0	0	0	0	27	3	0	0	0	0	0	0
164	0	0	0	0	0	28	4	0	0	0	0	0	0
165	0	0	0	0	0	29	5	0	0	0	0	0	0
166	0	0	0	0	0	30	6	0	0	0	0	0	0
167	0	0	0	0	0	31	7	0	0	0	0	0	0
168	0	0	0	0	0	32	8	0	0	0	0	0	0
169	0	0	0	0	0	33	9	0	0	0	0	0	0
170	0	0	0	0	0	34	10	0	0	0	0	0	0
171	0	0	0	0	0	35	11	0	0	0	0	0	0
172	0	0	0	0	0	36	12	0	0	0	0	0	0
173	0	0	0	0	0	37	13	0	0	0	0	0	0
174	0	0	0	0	0	38	14	0	0	0	0	0	0
175	0	0	0	0	0	39	15	0	0	0	0	0	0
176	0	0	0	0	0	40	16	0	0	0	0	0	0
177	0	0	0	0	0	0	17	0	0	0	0	0	0
178	0	0	0	0	0	0	18	0	0	0	0	0	0
179	0	0	0	0	0	0	19	0	0	0	0	0	0
180	0	0	0	0	0	0	20	0	0	0	0	0	0
181	0	0	0	0	0	0	21	0	0	0	0	0	0
182	0	0	0	0	0	0	22	0	0	0	0	0	0
183	0	0	0	0	0	0	23	0	0	0	0	0	0
184	0	0	0	0	0	0	24	0	0	0	0	0	0
185	0	0	0	0	0	0	25	0	0	0	0	0	0
186	0	0	0	0	0	0	26	0	0	0	0	0	0
187	0	0	0	0	0	0	27	0	0	0	0	0	0
188	0	0	0	0	0	0	28	0	0	0	0	0	0
189	0	0	0	0	0	0	29	0	0	0	0	0	0
190	0	0	0	0	0	0	30	0	0	0	0	0	0
191	0	0	0	0	0	0	31	0	0	0	0	0	0
192	0	0	0	0	0	0	32	0	0	0	0	0	0
193	0	0	0	0	0	0	0	0	0	0	0	0	0
194	0	0	0	0	0	0	0	0	0	0	0	0	0
195	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 3-1 (Continued)

Item No.	Tests AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
196	0	0	0	0	0	0	0	0	0	0	0	0	0
197	0	0	0	0	0	0	0	0	0	0	0	0	0
198	0	0	0	0	0	0	0	0	0	0	0	0	0
199	0	0	0	0	0	0	0	0	0	0	0	0	0
200	0	0	0	0	0	0	0	0	0	0	0	0	0
201	0	0	0	0	0	0	0	0	0	0	0	0	0
202	0	0	0	0	0	0	0	0	0	0	0	0	0
203	0	0	0	0	0	0	0	0	0	0	0	0	0
204	0	0	0	0	0	0	0	0	0	0	0	0	0
205	0	0	0	0	0	0	0	0	0	0	0	0	0
206	0	0	0	0	0	0	0	0	0	0	0	0	0
207	0	0	0	0	0	0	0	0	0	0	0	0	0
208	0	0	0	0	0	0	0	0	0	0	0	0	0
209	0	0	0	0	0	0	0	0	0	0	0	0	0
210	0	0	0	0	0	0	0	0	0	0	0	0	0
211	0	0	0	0	0	0	33	1	0	0	0	0	0
212	0	0	0	0	0	0	34	2	0	0	0	0	0
213	0	0	0	0	0	0	35	3	0	0	0	0	0
214	0	0	0	0	0	0	36	4	0	0	0	0	0
215	0	0	0	0	0	0	37	5	0	0	0	0	0
216	0	0	0	0	0	0	38	6	0	0	0	0	0
217	0	0	0	0	0	0	39	7	0	0	0	0	0
218	0	0	0	0	0	0	40	8	0	0	0	0	0
219	0	0	0	0	0	0	41	9	0	0	0	0	0
220	0	0	0	0	0	0	42	10	0	0	0	0	0
221	0	0	0	0	0	0	43	11	0	0	0	0	0
222	0	0	0	0	0	0	44	12	0	0	0	0	0
223	0	0	0	0	0	0	45	13	0	0	0	0	0
224	0	0	0	0	0	0	46	14	0	0	0	0	0
225	0	0	0	0	0	0	47	15	0	0	0	0	0
226	0	0	0	0	0	0	48	16	0	0	0	0	0
227	0	0	0	0	0	0	0	17	0	0	0	0	0
228	0	0	0	0	0	0	0	18	0	0	0	0	0
229	0	0	0	0	0	0	0	19	0	0	0	0	0
230	0	0	0	0	0	0	0	20	0	0	0	0	0
231	0	0	0	0	0	0	0	21	0	0	0	0	0
232	0	0	0	0	0	0	0	22	0	0	0	0	0
233	0	0	0	0	0	0	0	23	0	0	0	0	0
234	0	0	0	0	0	0	0	24	0	0	0	0	0
235	0	0	0	0	0	0	0	25	0	0	0	0	0
236	0	0	0	0	0	0	0	26	0	0	0	0	0
237	0	0	0	0	0	0	0	27	0	0	0	0	0
238	0	0	0	0	0	0	0	28	0	0	0	0	0
239	0	0	0	0	0	0	0	29	0	0	0	0	0
240	0	0	0	0	0	0	0	30	0	0	0	0	0
241	0	0	0	0	0	0	0	31	0	0	0	0	0
242	0	0	0	0	0	0	0	32	0	0	0	0	0
243	0	0	0	0	0	0	0	33	0	0	0	0	0
244	0	0	0	0	0	0	0	34	0	0	0	0	0
245	0	0	0	0	0	0	0	35	0	0	0	0	0
246	0	0	0	0	0	0	0	36	0	0	0	0	0
247	0	0	0	0	0	0	0	37	0	0	0	0	0
248	0	0	0	0	0	0	0	38	0	0	0	0	0
249	0	0	0	0	0	0	0	39	0	0	0	0	0
250	0	0	0	0	0	0	0	40	0	0	0	0	0
251	0	0	0	0	0	0	0	41	1	0	0	0	0
252	0	0	0	0	0	0	0	42	2	0	0	0	0
253	0	0	0	0	0	0	0	43	3	0	0	0	0
254	0	0	0	0	0	0	0	44	4	0	0	0	0
255	0	0	0	0	0	0	0	45	5	0	0	0	0
256	0	0	0	0	0	0	0	46	6	0	0	0	0
257	0	0	0	0	0	0	0	47	7	0	0	0	0
258	0	0	0	0	0	0	0	48	8	0	0	0	0
259	0	0	0	0	0	0	0	49	9	0	0	0	0
260	0	0	0	0	0	0	0	50	10	0	0	0	0
261	0	0	0	0	0	0	0	51	11	0	0	0	0

TABLE 3-1 (Continued)

Item No.	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
	Tests												
262	0	0	0	0	0	0	0	52	12	0	0	0	0
263	0	0	0	0	0	0	0	53	13	0	0	0	0
264	0	0	0	0	0	0	0	54	14	0	0	0	0
265	0	0	0	0	0	0	0	55	15	0	0	0	0
266	0	0	0	0	0	0	0	56	16	0	0	0	0
267	0	0	0	0	0	0	0	0	17	0	0	0	0
268	0	0	0	0	0	0	0	0	18	0	0	0	0
269	0	0	0	0	0	0	0	0	19	0	0	0	0
270	0	0	0	0	0	0	0	0	20	0	0	0	0
271	0	0	0	0	0	0	0	0	21	0	0	0	0
272	0	0	0	0	0	0	0	0	22	0	0	0	0
273	0	0	0	0	0	0	0	0	23	0	0	0	0
274	0	0	0	0	0	0	0	0	24	0	0	0	0
275	0	0	0	0	0	0	0	0	25	0	0	0	0
276	0	0	0	0	0	0	0	0	26	0	0	0	0
277	0	0	0	0	0	0	0	0	27	0	0	0	0
278	0	0	0	0	0	0	0	0	28	0	0	0	0
279	0	0	0	0	0	0	0	0	29	0	0	0	0
280	0	0	0	0	0	0	0	0	30	0	0	0	0
281	0	0	0	0	0	0	0	0	31	0	0	0	0
282	0	0	0	0	0	0	0	0	32	0	0	0	0
283	0	0	0	0	0	0	0	0	33	0	0	0	0
284	0	0	0	0	0	0	0	0	34	0	0	0	0
285	0	0	0	0	0	0	0	0	35	0	0	0	0
286	0	0	0	0	0	0	0	0	36	0	0	0	0
287	0	0	0	0	0	0	0	0	37	1	0	0	0
288	0	0	0	0	0	0	0	0	38	2	0	0	0
289	0	0	0	0	0	0	0	0	39	3	0	0	0
290	0	0	0	0	0	0	0	0	40	4	0	0	0
291	0	0	0	0	0	0	0	0	41	5	0	0	0
292	0	0	0	0	0	0	0	0	42	6	0	0	0
293	0	0	0	0	0	0	0	0	43	7	0	0	0
294	0	0	0	0	0	0	0	0	44	8	0	0	0
295	0	0	0	0	0	0	0	0	45	9	0	0	0
296	0	0	0	0	0	0	0	0	46	10	0	0	0
297	0	0	0	0	0	0	0	0	47	11	0	0	0
298	0	0	0	0	0	0	0	0	48	12	0	0	0
299	0	0	0	0	0	0	0	0	49	13	0	0	0
300	0	0	0	0	0	0	0	0	50	14	0	0	0
301	0	0	0	0	0	0	0	0	51	15	0	0	0
302	0	0	0	0	0	0	0	0	52	16	0	0	0
303	0	0	0	0	0	0	0	0	53	17	0	0	0
304	0	0	0	0	0	0	0	0	54	18	0	0	0
305	0	0	0	0	0	0	0	0	55	19	0	0	0
306	0	0	0	0	0	0	0	0	56	20	0	0	0
307	0	0	0	0	0	0	0	0	0	21	0	0	0
308	0	0	0	0	0	0	0	0	0	22	0	0	0
309	0	0	0	0	0	0	0	0	0	23	0	0	0
310	0	0	0	0	0	0	0	0	0	24	0	0	0
311	0	0	0	0	0	0	0	0	0	25	0	0	0
312	0	0	0	0	0	0	0	0	0	26	0	0	0
313	0	0	0	0	0	0	0	0	0	27	0	0	0
314	0	0	0	0	0	0	0	0	0	28	0	0	0
315	0	0	0	0	0	0	0	0	0	29	0	0	0
316	0	0	0	0	0	0	0	0	0	30	0	0	0
317	0	0	0	0	0	0	0	0	0	31	0	0	0
318	0	0	0	0	0	0	0	0	0	32	0	0	0
319	0	0	0	0	0	0	0	0	0	33	0	0	0
320	0	0	0	0	0	0	0	0	0	34	0	0	0
321	0	0	0	0	0	0	0	0	0	35	0	0	0
322	0	0	0	0	0	0	0	0	0	36	0	0	0
323	0	0	0	0	0	0	0	0	0	37	0	0	0
324	0	0	0	0	0	0	0	0	0	38	0	0	0
325	0	0	0	0	0	0	0	0	0	39	0	0	0
326	0	0	0	0	0	0	0	0	0	40	0	0	0
327	0	0	0	0	0	0	0	0	0	41	1	0	0

TABLE 3-1 (Continued)

Item No.	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
	Tests												
328	0	0	0	0	0	0	0	0	0	42	2	0	0
329	0	0	0	0	0	0	0	0	0	43	3	0	0
330	0	0	0	0	0	0	0	0	0	44	4	0	0
331	0	0	0	0	0	0	0	0	0	45	5	0	0
332	0	0	0	0	0	0	0	0	0	46	6	0	0
333	0	0	0	0	0	0	0	0	0	47	7	0	0
334	0	0	0	0	0	0	0	0	0	48	8	0	0
335	0	0	0	0	0	0	0	0	0	49	9	0	0
336	0	0	0	0	0	0	0	0	0	50	10	0	0
337	0	0	0	0	0	0	0	0	0	51	11	0	0
338	0	0	0	0	0	0	0	0	0	52	12	0	0
339	0	0	0	0	0	0	0	0	0	53	13	0	0
340	0	0	0	0	0	0	0	0	0	54	14	0	0
341	0	0	0	0	0	0	0	0	0	55	15	0	0
342	0	0	0	0	0	0	0	0	0	56	16	0	0
343	0	0	0	0	0	0	0	0	0	57	17	0	0
344	0	0	0	0	0	0	0	0	0	58	18	0	0
345	0	0	0	0	0	0	0	0	0	59	19	0	0
346	0	0	0	0	0	0	0	0	0	60	20	0	0
347	0	0	0	0	0	0	0	0	0	0	0	0	0
348	0	0	0	0	0	0	0	0	0	0	0	0	0
349	0	0	0	0	0	0	0	0	0	0	0	0	0
350	0	0	0	0	0	0	0	0	0	0	0	0	0
351	0	0	0	0	0	0	0	0	0	0	0	0	0
352	0	0	0	0	0	0	0	0	0	0	0	0	0
353	0	0	0	0	0	0	0	0	0	0	0	0	0
354	0	0	0	0	0	0	0	0	0	0	0	0	0
355	0	0	0	0	0	0	0	0	0	0	0	0	0
356	0	0	0	0	0	0	0	0	0	0	0	0	0
357	0	0	0	0	0	0	0	0	0	0	0	0	0
358	0	0	0	0	0	0	0	0	0	0	0	0	0
359	0	0	0	0	0	0	0	0	0	0	0	0	0
360	0	0	0	0	0	0	0	0	0	0	0	0	0
361	0	0	0	0	0	0	0	0	0	0	21	0	0
362	0	0	0	0	0	0	0	0	0	0	22	0	0
363	0	0	0	0	0	0	0	0	0	0	23	0	0
364	0	0	0	0	0	0	0	0	0	0	24	0	0
365	0	0	0	0	0	0	0	0	0	0	25	0	0
366	0	0	0	0	0	0	0	0	0	0	26	0	0
367	0	0	0	0	0	0	0	0	0	0	27	0	0
368	0	0	0	0	0	0	0	0	0	0	28	0	0
369	0	0	0	0	0	0	0	0	0	0	29	0	0
370	0	0	0	0	0	0	0	0	0	0	30	0	0
371	0	0	0	0	0	0	0	0	0	0	31	0	0
372	0	0	0	0	0	0	0	0	0	0	32	0	0
373	0	0	0	0	0	0	0	0	0	0	33	0	0
374	0	0	0	0	0	0	0	0	0	0	34	0	0
375	0	0	0	0	0	0	0	0	0	0	35	0	0
376	0	0	0	0	0	0	0	0	0	0	36	0	0
377	0	0	0	0	0	0	0	0	0	0	37	0	0
378	0	0	0	0	0	0	0	0	0	0	38	0	0
379	0	0	0	0	0	0	0	0	0	0	39	0	0
380	0	0	0	0	0	0	0	0	0	0	40	0	0
381	0	0	0	0	0	0	0	0	0	0	41	1	0
382	0	0	0	0	0	0	0	0	0	0	42	2	0
383	0	0	0	0	0	0	0	0	0	0	43	3	0
384	0	0	0	0	0	0	0	0	0	0	44	4	0
385	0	0	0	0	0	0	0	0	0	0	45	5	0
386	0	0	0	0	0	0	0	0	0	0	46	6	0
387	0	0	0	0	0	0	0	0	0	0	47	7	0
388	0	0	0	0	0	0	0	0	0	0	48	8	0
389	0	0	0	0	0	0	0	0	0	0	49	9	0
390	0	0	0	0	0	0	0	0	0	0	50	10	0
391	0	0	0	0	0	0	0	0	0	0	51	11	0
392	0	0	0	0	0	0	0	0	0	0	52	12	0
393	0	0	0	0	0	0	0	0	0	0	53	13	0

TABLE 3-1 (Continued)

Item No.	Tests AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
394	0	0	0	0	0	0	0	0	0	0	54	14	0
395	0	0	0	0	0	0	0	0	0	0	55	15	0
396	0	0	0	0	0	0	0	0	0	0	56	16	0
397	0	0	0	0	0	0	0	0	0	0	57	17	0
398	0	0	0	0	0	0	0	0	0	0	58	18	0
399	0	0	0	0	0	0	0	0	0	0	59	19	0
400	0	0	0	0	0	0	0	0	0	0	60	20	0
401	0	0	0	0	0	0	0	0	0	0	0	21	0
402	0	0	0	0	0	0	0	0	0	0	0	22	0
403	0	0	0	0	0	0	0	0	0	0	0	23	0
404	0	0	0	0	0	0	0	0	0	0	0	24	0
405	0	0	0	0	0	0	0	0	0	0	0	25	0
406	0	0	0	0	0	0	0	0	0	0	0	26	0
407	0	0	0	0	0	0	0	0	0	0	0	27	0
408	0	0	0	0	0	0	0	0	0	0	0	28	0
409	0	0	0	0	0	0	0	0	0	0	0	29	0
410	0	0	0	0	0	0	0	0	0	0	0	30	0
411	0	0	0	0	0	0	0	0	0	0	0	31	0
412	0	0	0	0	0	0	0	0	0	0	0	32	0
413	0	0	0	0	0	0	0	0	0	0	0	33	0
414	0	0	0	0	0	0	0	0	0	0	0	34	0
415	0	0	0	0	0	0	0	0	0	0	0	35	0
416	0	0	0	0	0	0	0	0	0	0	0	36	0
417	0	0	0	0	0	0	0	0	0	0	0	37	0
418	0	0	0	0	0	0	0	0	0	0	0	38	0
419	0	0	0	0	0	0	0	0	0	0	0	39	0
420	0	0	0	0	0	0	0	0	0	0	0	40	0
421	0	0	0	0	0	0	0	0	0	0	0	41	1
422	0	0	0	0	0	0	0	0	0	0	0	42	2
423	0	0	0	0	0	0	0	0	0	0	0	43	3
424	0	0	0	0	0	0	0	0	0	0	0	44	4
425	0	0	0	0	0	0	0	0	0	0	0	45	5
426	0	0	0	0	0	0	0	0	0	0	0	46	6
427	0	0	0	0	0	0	0	0	0	0	0	47	7
428	0	0	0	0	0	0	0	0	0	0	0	48	8
429	0	0	0	0	0	0	0	0	0	0	0	49	9
430	0	0	0	0	0	0	0	0	0	0	0	50	10
431	0	0	0	0	0	0	0	0	0	0	0	51	11
432	0	0	0	0	0	0	0	0	0	0	0	52	12
433	0	0	0	0	0	0	0	0	0	0	0	53	13
434	0	0	0	0	0	0	0	0	0	0	0	54	14
435	0	0	0	0	0	0	0	0	0	0	0	55	15
436	0	0	0	0	0	0	0	0	0	0	0	56	16
437	0	0	0	0	0	0	0	0	0	0	0	57	17
438	0	0	0	0	0	0	0	0	0	0	0	58	18
439	0	0	0	0	0	0	0	0	0	0	0	59	19
440	0	0	0	0	0	0	0	0	0	0	0	60	20
441	0	0	0	0	0	0	0	0	0	0	0	0	21
442	0	0	0	0	0	0	0	0	0	0	0	0	22
443	0	0	0	0	0	0	0	0	0	0	0	0	23
444	0	0	0	0	0	0	0	0	0	0	0	0	24
445	0	0	0	0	0	0	0	0	0	0	0	0	25
446	0	0	0	0	0	0	0	0	0	0	0	0	26
447	0	0	0	0	0	0	0	0	0	0	0	0	27
448	0	0	0	0	0	0	0	0	0	0	0	0	28
449	0	0	0	0	0	0	0	0	0	0	0	0	29
450	0	0	0	0	0	0	0	0	0	0	0	0	30
451	0	0	0	0	0	0	0	0	0	0	0	0	31
452	0	0	0	0	0	0	0	0	0	0	0	0	32
453	0	0	0	0	0	0	0	0	0	0	0	0	33
454	0	0	0	0	0	0	0	0	0	0	0	0	34
455	0	0	0	0	0	0	0	0	0	0	0	0	35
456	0	0	0	0	0	0	0	0	0	0	0	0	36
457	0	0	0	0	0	0	0	0	0	0	0	0	37
458	0	0	0	0	0	0	0	0	0	0	0	0	38
459	0	0	0	0	0	0	0	0	0	0	0	0	39

TABLE 3-1 (Continued)

Item No.	AP1	AP2	A1	A2	A3	A4	A5	A6	J1	J2	S1	S2	U2
460	0	0	0	0	0	0	0	0	0	0	0	0	40
461	0	0	0	0	0	0	0	0	0	0	0	0	41
462	0	0	0	0	0	0	0	0	0	0	0	0	42
463	0	0	0	0	0	0	0	0	0	0	0	0	43
464	0	0	0	0	0	0	0	0	0	0	0	0	44
465	0	0	0	0	0	0	0	0	0	0	0	0	45
466	0	0	0	0	0	0	0	0	0	0	0	0	46
467	0	0	0	0	0	0	0	0	0	0	0	0	47
468	0	0	0	0	0	0	0	0	0	0	0	0	48
469	0	0	0	0	0	0	0	0	0	0	0	0	49
470	0	0	0	0	0	0	0	0	0	0	0	0	50
471	0	0	0	0	0	0	0	0	0	0	0	0	51
472	0	0	0	0	0	0	0	0	0	0	0	0	52
473	0	0	0	0	0	0	0	0	0	0	0	0	53
474	0	0	0	0	0	0	0	0	0	0	0	0	54
475	0	0	0	0	0	0	0	0	0	0	0	0	55
476	0	0	0	0	0	0	0	0	0	0	0	0	56
477	0	0	0	0	0	0	0	0	0	0	0	0	57
478	0	0	0	0	0	0	0	0	0	0	0	0	0
479	0	0	0	0	0	0	0	0	0	0	0	0	0
480	0	0	0	0	0	0	0	0	0	0	0	0	0

Test A5: 599 fifth graders in elementary schools
Test A6: 412 sixth graders in elementary schools
Test J1: 614 first graders in junior high schools
Test J2: 758 third graders in junior high schools

For convenience, hereafter, we shall call these groups of examinees and their performances A5/0599 Case, A6/0412 Case, J1/0614 Case and J2/0758 Case, respectively. There are also 461 second graders in junior high school who took Test J1 in Shiba's original data. In order to increase the number of examinees, this group of 461 subjects and their performances were added to the J1/0614 Case, to provide us with the J1/1075 Case. This case was further joined by an additional group of 1,184 students of four different junior high schools in Tokyo, to whom Test J1 was adminis[illegible] in some other research of Shiba's. We shall call this larg[illegible] group of examinees and their performances J1/2259 Case. Thus we have six cases in total, with three of them partly overlapping.

When the item parameter estimation was made by Logist 5, in some cases two or more tests and the corresponding samples of examinees were combined, in order to increase the number of test items and hence to improve the accuracy of estimation. Table 3-2 presents the resulting combinations of tests and the numbers of examinees, as well as other additional information. Since there are overlapping test items between two adjacent tests, such as Tests A5 and A6, for example, the total number of items is less than the sum of the numbers of items in the separate tests, when two or more tests are combined. As for the numbers of examinees, in all the combined cases they are the direct sums of the separate cases. Thus when Tests A5 and A6 are

TABLE 3-2

Tests, Numbers of Items, Numbers of Examinees And Other Information for Thirteen Different Cases.

Method		Test(s)	No. of Examinees	Original No. of Items	Excluded Items	No. of Items Included
Tetrachoric Method (Shiba)		A5	599	48	3,13,17	45
		A6	412	56	--	56
		J1	614	56	38	55
		J2	758	60	2	59
Tetrachoric Method (Samejima)		J1	1,074	56	38	55
		J1	2,259	56	38	55
Logist 5	0.0	A5,A6	1,011	88	--	88
	0.0	J1,J2	1,833	96	--	96
c_g:	0.0	A5,A6,J1,J2	2,844	168	--	168
	0.0	J1	1,075	56	38	55
	free	J1	1,075	56	38	55
	0.0	J1	2,259	56	38	55
	free	J1	2,259	56	38	55

combined, the 1,011 examinees are the sum of the two subject groups of 599 and 412 examinees in the A5/0599 and A6/412 Cases; when Tests J1 and J2 are combined, the 1,833 examinees are the sum of the two subject groups of 1,075 and 758 examinees in the J1/1075 and J2/758 Cases; and, when Tests A5, A6, J1 and J2 are combined, the 2,844 subjects are the sum of the four subject groups of 599, 412, 1,075 and 758 examinees in the A5/599, A6/412, J1/1075 and J2/758 Cases.

IV. Tetrachoric Method

It has been observed that, when the group of subjects is an unselected sample from, say, an age group of subjects, in a certain geographical area, normal assumption tends to fit well for the joint distribution of response tendencies (e.g., Samejima, ONR/RR-84-1). Thus we can use the (nxn) tetrachoric correlation matrix based upon the response tendencies behind the n test items and factor analyze the result to confirm the unidimensionality of the underlying latent trait. If it is confirmed, then the estimates of the item discrimination and item difficulty parameters, a_g and b_g, in the normal ogive model will be given by

$$(4.1) \qquad \hat{a}_g = \rho_g(1-\rho_g{}^2)^{-1/2}$$

and

$$(4.2) \qquad \hat{b}_g = \hat{\gamma}_g \, \rho_g{}^{-1} \qquad ,$$

where ρ_g is the factor loading of item g on the first common

factor and $\hat{\gamma}_g$ is the normal deviate corresponding to the proportion-correct $\hat{p}_g$ of item g, or we can write

$$(4.3) \qquad \hat{\gamma}_g = \Phi^{-1}(1-\hat{p}_g)$$

with Φ^{-1} representing the inverse function of the standard normal distribution function.

For brevity, we shall call this method for estimating the item parameters a_g and b_g in the normal ogive model Tetrachoric Method. It has been shown (Samejima, ONR/RR-84-1) that this method can be used in selecting Old Test items in the non-parametric estimation of the operating characteristics, with additional procedures for validating the normal assumption and so forth.

V. Estimated Item Parameters Based upon the Tetrachoric Method

In his original research (Shiba, 1978) Shiba used the Tetrachoric Method in estimating the item parameters. Tables 5-1 through 5-4 present the estimated item parameters of each test item of Tests A5, A6, J1 and J2 obtained by Shiba. Those values were based upon the four separate scales of θ, whose origins and units are adjusted to the means and standard deviations of the separate ability distributions of the A5/0599, A6/0412, J1/0614 and J2/0758 Cases, respectively. In these tables and throughout the rest of the paper, in order to avoid confusion, each item number is preceded by the name of the test. Thus item A501 indicates item 1 of Test A5, item A604

TABLE 5-1

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	$\hat{a}_g$	$\hat{b}_g$
A501	0.643	-1.737
A502	0.467	-2.882
A503	---	---
A504	0.571	-1.412
A505	0.664	-1.881
A506	0.437	-1.349
A507	0.424	-0.077
A508	0.683	-1.135
A509	1.061	-1.360
A510	0.593	-0.020
A511	0.461	-1.481
A512	0.594	-1.273
A513	---	---
A514	0.777	-1.190
A515	0.450	-1.682
A516	0.380	1.830
A517	---	---
A518	0.339	-1.995
A519	0.639	-1.282
A520	0.350	-2.636
A521	0.569	-1.275
A522	0.444	0.296
A523	0.075 ▲	7.376 ▲
A524	0.392	-1.451
A525	0.810	-1.398
A526	0.777	0.130
A527	0.076 ▲	0.925
A528	0.416	1.015
A529	0.494	0.429
A530	0.543	-1.069
A531	-0.050 ▲	-26.476 ▲
A532	0.477	1.184
A533	0.686	-1.096
A534	0.791	-1.467
A535	0.520	-0.520
A536	0.656	-0.146
A537	0.468	-0.755
A538	0.930	0.103
A539	0.658	-0.146
A540	0.378	0.226

Item g	$\hat{a}_g$	$\hat{b}_g$
A541	0.547	-0.042
A542	0.436	-0.675
A543	0.555	-0.619
A544	0.755	0.780
A545	0.709	0.346
A546	0.218	2.068
A547	0.289	0.505
A548	0.416	1.015

TABLE 5-2

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	$\hat{a}_g$	$\hat{b}_g$
A601	0.664	-1.862
A602	0.517	-2.699
A603	0.776	-1.028
A604	0.581	-1.115
A605	0.596	-0.664
A606	1.143	-0.877
A607	0.745	-0.653
A608	0.564	-0.204
A609	0.558	-0.431
A610	0.492	-1.132
A611	0.660	-0.200
A612	0.794	-0.466
A613	1.085	-0.272
A614	0.519	0.564
A615	0.310	0.067
A616	0.570	0.242
A617	0.818	-1.422
A618	0.499	-0.919
A619	0.561	-0.920
A620	0.925	-0.206
A621	0.803	-0.639
A622	0.546	-1.524
A623	0.452	-1.238
A624	0.552	-2.028
A625	0.402	-1.607
A626	0.508	-0.728
A627	0.325	-0.097
A628	0.215	-2.900
A629	0.626	-0.264
A630	0.631	-0.656
A631	0.591	-0.491
A632	0.597	-1.189
A633	0.383	-0.894
A634	0.923	-1.504
A635	0.707	-2.217
A636	0.635	-1.455
A637	0.475	-0.816
A638	0.421	1.341
A639	0.034 ▲	22.634 ▲
A640	0.561	0.245

Item g	$\hat{a}_g$	$\hat{b}_g$
A641	0.628	0.564
A642	0.673	-0.967
A643	0.707	-0.520
A644	1.132	-0.040
A645	0.472	0.117
A646	0.501	-0.447
A647	0.566	0.792
A648	0.733	-1.590
A649	0.458	-0.432
A650	0.579	0.040
A651	0.611	-0.595
A652	0.281	-0.740
A653	0.572	-0.363
A654	0.232	2.918
A655	0.838	-0.031
A656	0.498	-1.099

TABLE 5-3

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	$\hat{a}_g$	$\hat{b}_g$
J101	0.668	0.072
J102	0.599	-0.817
J103	0.664	-1.013
J104	0.727	-0.799
J105	0.686	-0.301
J106	0.475	-0.815
J107	0.497	0.090
J108	0.809	-2.051
J109	0.470	-1.011
J110	0.678	-0.517
J111	0.901	-1.329
J112	0.521	-0.714
J113	0.553	-0.930
J114	0.513	0.657
J115	0.767	-0.279
J116	0.406	-1.117
J117	0.390	-0.880
J118	0.594	-0.959
J119	0.659	-0.926
J120	0.191	2.502
J121	0.482	-0.967
J122	0.524	-0.819
J123	0.552	0.103
J124	0.560	-1.863
J125	0.567	-1.541
J126	0.383	-0.727
J127	0.531	-1.643
J128	0.630	-1.144
J129	0.812	1.174
J130	0.379	-1.805
J131	0.905	-0.447
J132	0.454	0.0
J133	0.614	-1.873
J134	0.287	2.244
J135	0.819	-0.205
J136	0.371	0.374
J137	0.580	0.0
J138	---	---
J139	0.362	1.321
J140	0.403	0.107

Item g	$\hat{a}_g$	$\hat{b}_g$
J141	0.549	-0.894
J142	0.400	0.566
J143	0.620	-0.190
J144	0.452	-0.510
J145	0.798	-0.401
J146	0.727	-0.051
J147	0.267	1.125
J148	0.542	0.231
J149	0.499	-0.224
J150	0.524	-0.237
J151	0.424	0.999
J152	0.309	0.847
J153	0.438	1.696
J154	0.100	5.150▲
J155	0.569	1.536
J156	0.630	1.313

TABLE 5-4

Estimated Item Discrimination Parameter $\hat{a}_g$ And Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2 Obtained by the Tetrachoric Method. (Results Provided by the Courtesy of Professor Shiba.)

Item g	$\hat{a}_g$	$\hat{b}_g$	Item g	$\hat{a}_g$	$\hat{b}_g$
J201	0.607	-1.485	J241	1.024	-1.174
J202	---	---	J242	0.764	-0.939
J203	0.517	0.327	J243	0.411	-0.789
J204	0.374	-0.941	J244	0.360	-0.266
J205	0.526	-2.126	J245	0.866	-0.122
J206	0.557	-0.904	J246	0.278	0.112
J207	0.754	-1.329	J247	0.541	-0.210
J208	0.415	-2.009	J248	0.404	-1.762
J209	0.859	-0.936	J249	0.743	-0.285
J210	0.609	-1.883	J250	0.717	-0.378
J211	0.681	-0.906	J251	0.906	-0.938
J212	0.671	-1.041	J252	0.591	-0.059
J213	0.593	-1.079	J253	0.598	0.019
J214	0.596	-0.899	J254	0.613	-0.038
J215	0.937	-0.263	J255	1.146	0.066
J216	0.662	-0.598	J256	0.582	0.477
J217	0.515	0.262	J257	0.538	-0.317
J218	0.685	-0.106	J258	0.454	0.121
J219	1.008	-0.310	J259	0.825	0.189
J220	1.174	0.131	J260	0.091 ▲	1.773
J221	0.430	0.341			
J222	0.721	-0.650			
J223	0.462	-1.551			
J224	0.697	-0.682			
J225	0.689	-1.234			
J226	0.688	-0.653			
J227	0.663	-0.995			
J228	0.667	-1.387			
J229	0.653	-1.098			
J230	0.603	-1.065			
J231	1.195	-1.213			
J232	0.890	-1.309			
J233	0.354	0.540			
J234	0.386	0.028			
J235	0.972	-0.631			
J236	0.917	-0.533			
J237	0.283	-1.212			
J238	0.886	0.709			
J239	0.539	-0.190			
J240	0.[illegible]92	0.246			

means item 4 of Test A6, and so forth. We can see in these tables that the estimated item parameters are mostly reasonable with a few exceptions. In these tables, ▲ is attached to each of the estimated discrimination parameters which assume values less than 0.100 , and to each of the estimated difficulty parameters which exceed 3.000 in absolute value. Those items which are marked for both estimated parameters are A523, A531 and A639. We must conclude for these items that not only the information provided by them for measuring the ability in question is limited, but their estimated parameters may include substantial error. The closest to this group of items is item J154, whose estimated difficulty parameter exceeds 3.000 in absolute value and whose estimated discrimination parameter is just 0.100 . The other group consists of items A527 and J260, whose estimated discrimination parameters are small, but whose estimated difficulty parameters are reasonable. There is less problem for these two items.

For J1/1075* and J1/2259** Cases, we followed the same procedure of Tetrachoric Method independently, and obtained the corresponding results. To start with, Tables 5-5 and 5-6 present the

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* There was a mistake in the tape sent to us and one subject's response pattern (Subject No. 231 of the second grader group) was missing. Thus actually 1,074 subjects are involved in the whole process of Tetrachoric Method, as Table 3-2 indicates. In order to avoid confusions, however, we call it J1/1075 Case, instead of J1/1074.

** Since J1/2559 Case was analyzed later, the response pattern of the missing subject had been supplemented, and J1/2559 Case in the Tetrachoric Method consists of exactly 2,259 subjects.

TABLE 5-5

Tetrachoric Correlation Matrix of the Fifty-Five Item Response Tendencies of Test J1 in the J1/1075 Case.

	J101	J102	J103	J104	J105	J106	J107	J108	J109	J110
	J111	J112	J113	J114	J115	J116	J117	J118	J119	J120
	J121	J122	J123	J124	J125	J126	J127	J128	J129	J130
	J131	J132	J133	J134	J135	J136	J137	J139	J140	J141
	J142	J143	J144	J145	J146	J147	J148	J149	J150	J151
	J152	J153	J154	J155	J156					
J101	1.00000	0.30935	0.39791	0.33850	0.29904	0.26317	0.27566	0.30272	0.25337	0.29338
	0.43044	0.31305	0.29421	0.41238	0.41056	0.10827	0.10115	0.30170	0.24789	0.17085
	0.28498	0.26612	0.35337	0.30091	0.22179	0.29616	0.32307	0.41196	0.35104	0.17697
	0.41732	0.25297	0.27088	0.23282	0.28907	0.17383	0.33124	0.18293	0.18859	0.25425
	0.27917	0.32995	0.26562	0.33467	0.39184	0.26608	0.30593	0.22554	0.32048	0.36767
	0.20212	0.25670	0.12231	0.50233	0.40676					
J102	0.30935	1.00000	0.31529	0.30305	0.30809	0.28091	0.25633	0.41906	0.17834	0.25370
	0.34997	0.22497	0.26707	0.27568	0.27853	0.18069	0.19496	0.25638	0.24492	0.08870
	0.27005	0.22062	0.11891	0.22486	0.23874	0.12534	0.21914	0.29098	0.20666	0.18698
	0.28704	0.17355	0.30148	0.15517	0.27531	0.09861	0.29579	0.23516	0.20962	0.25229
	0.18193	0.31944	0.14041	0.28241	0.24416	0.20532	0.21318	0.26038	0.22078	0.20238
	0.19437	0.06023	0.04128	0.13424	0.17818					
J103	0.39791	0.31529	1.00000	0.31744	0.23228	0.26850	0.35556	0.24811	0.22524	0.35196
	0.35062	0.32353	0.22025	0.26182	0.36242	0.22497	0.22868	0.36420	0.22347	0.13660
	0.20870	0.24935	0.38642	0.26607	0.34852	0.20407	0.36412	0.40914	0.27403	0.12592
	0.33368	0.16632	0.18727	0.23758	0.33274	0.19019	0.28462	0.20189	0.18978	0.20981
	0.21874	0.25807	0.14719	0.20593	0.38369	0.16622	0.29989	0.23038	0.23544	0.21631
	0.23761	0.01170	0.08639	0.36941	0.29599					
J104	0.33850	0.30305	0.31744	1.00000	0.41568	0.28443	0.31946	0.31191	0.25248	0.31245
	0.33496	0.25405	0.28219	0.32413	0.35373	0.19969	0.15717	0.24053	0.32057	0.12947
	0.24170	0.23749	0.29589	0.32421	0.26304	0.32498	0.23714	0.41057	0.37698	0.14477
	0.34746	0.19570	0.39260	0.12542	0.36065	0.25693	0.31862	0.22096	0.07251	0.33079
	0.25548	0.30614	0.16709	0.33730	0.43372	0.25675	0.14977	0.27139	0.20638	0.28149
	0.15200	0.25177	0.11713	0.41511	0.21442					
J105	0.29904	0.30809	0.23228	0.41568	1.00000	0.29312	0.30232	0.44853	0.25363	0.31644
	0.47107	0.24694	0.32003	0.31609	0.36300	0.25139	0.24167	0.25397	0.33025	0.13519
	0.29810	0.27993	0.22910	0.28829	0.22380	0.32957	0.23853	0.40782	0.39773	0.27811
	0.41186	0.22375	0.40366	0.11593	0.39351	0.18305	0.34411	0.30141	0.28357	0.31226
	0.28904	0.35195	0.18740	0.37501	0.43003	0.23939	0.22455	0.21483	0.27306	0.22244
	0.08615	0.34016	0.16381	0.35953	0.32183					
J106	0.26317	0.28091	0.26850	0.28443	0.29312	1.00000	0.21749	0.26835	0.20142	0.30066
	0.30290	0.25569	0.28171	0.15104	0.24364	0.27501	0.23397	0.15257	0.39619	0.04769
	0.16951	0.20257	0.19162	0.14858	0.27441	0.23606	0.21319	0.20040	0.23384	0.22951
	0.26897	0.18490	0.15530	0.05990	0.28331	0.15893	0.30218	0.19954	0.09121	0.20420
	0.24516	0.27060	0.08533	0.29660	0.27384	0.15284	0.09620	0.18986	0.22531	0.15927
	0.12626	0.17371	0.05026	0.26586	0.18373					

TABLE 5-5 (Continued)

J107	0.27566	0.25633	0.35556	0.31946	0.30232	0.21749	1.00000	0.38260	0.16603	0.30616
	0.29424	0.10439	0.27734	0.21249	0.29084	0.15821	0.11978	0.30982	0.31161	0.11346
	0.19877	0.23987	0.23634	0.31750	0.25268	0.16091	0.33629	0.31408	0.31976	0.16672
	0.27793	0.09383	0.34322	0.09937	0.29201	0.23296	0.21356	0.15641	0.16495	0.22641
	0.20428	0.25931	0.09870	0.24559	0.37316	0.24477	0.25184	0.21071	0.20921	0.12110
	0.12033	0.23199	0.07357	0.27923	0.26611					
J108	0.30272	0.41906	0.24811	0.31191	0.44853	0.26835	0.38260	1.00000	0.0	0.27627
	0.49299	0.31901	0.32654	0.31789	0.44662	0.31252	0.18635	0.11513	0.29577	0.09096
	0.27955	0.37888	0.26652	0.38822	0.41225	0.21464	0.40184	0.38467	0.38065	0.19478
	0.41433	0.25082	0.50813	0.09428	0.48109	0.28623	0.31035	0.13553	0.21231	0.33403
	0.18594	0.35370	0.17812	0.52473	0.41778	0.16518	0.28929	0.32300	0.33827	0.21229
	0.16262	0.17956	0.26073	0.27832	0.18057					
J109	0.25337	0.17834	0.22524	0.25248	0.25363	0.20142	0.16603	0.0	1.00000	0.16851
	0.23214	0.15586	0.13365	0.18667	0.20073	0.13181	0.13657	0.22954	0.22336	0.09710
	0.16344	0.15536	0.11748	0.21577	0.23167	0.13910	0.11509	0.19003	0.08135	0.13728
	0.21000	0.03619	0.0	0.04800	0.21358	0.08312	0.05303	0.12973	0.17916	0.13328
	0.14266	0.14281	0.17360	0.19348	0.18594	0.10596	0.13237	0.20065	0.21071	0.12203
	0.09904	0.06880	0.0	0.07630	0.21518					
J110	0.29338	0.25370	0.35196	0.31245	0.31644	0.30066	0.30616	0.27627	0.16851	1.00000
	0.38309	0.14885	0.20979	0.22535	0.33430	0.11796	0.24586	0.24232	0.27613	0.07026
	0.21413	0.30197	0.28361	0.17672	0.25418	0.24969	0.19251	0.30240	0.40160	0.26607
	0.35462	0.11064	0.33105	0.10775	0.40160	0.07856	0.30840	0.27039	0.23907	0.47275
	0.24825	0.30468	0.23106	0.28809	0.48460	0.08262	0.24220	0.25461	0.25399	0.06866
	0.08803	0.34082	0.0	0.31906	0.26012					
J111	0.43044	0.34997	0.35062	0.33496	0.47107	0.30290	0.29424	0.49299	0.23214	0.38309
	1.00000	0.29991	0.28153	0.36773	0.40822	0.22914	0.18871	0.38888	0.36003	0.20238
	0.30082	0.43076	0.29071	0.39165	0.27795	0.34872	0.38708	0.49329	0.33595	0.26235
	0.41930	0.26165	0.49849	0.19446	0.46664	0.28752	0.40033	0.13212	0.29698	0.40603
	0.26097	0.39801	0.25324	0.44287	0.44083	0.22931	0.27728	0.33430	0.30632	0.43459
	0.18757	0.23415	0.09266	0.35113	0.34134					
J112	0.31305	0.22497	0.32353	0.25405	0.24694	0.25569	0.10439	0.31901	0.15586	0.14885
	0.29991	1.00000	0.25967	0.30566	0.28159	0.04621	0.13193	0.22898	0.26138	0.09441
	0.16739	0.20785	0.12542	0.26464	0.24627	0.12038	0.21514	0.27918	0.18720	0.13179
	0.35070	0.25021	0.31648	0.07637	0.19771	0.24680	0.25671	0.11048	0.06551	0.17846
	0.13927	0.24174	0.05547	0.31002	0.30341	0.23901	0.24748	0.14965	0.18757	0.24104
	0.18194	0.03851	0.06170	0.23069	0.21416					
J113	0.29421	0.26707	0.22025	0.28219	0.32003	0.28171	0.27734	0.32654	0.13365	0.20979
	0.28153	0.25967	1.00000	0.25795	0.26050	0.15725	0.19161	0.29228	0.33101	0.16131
	0.24081	0.22810	0.24109	0.18516	0.24314	0.18226	0.30674	0.25529	0.27674	0.13231
	0.30175	0.20846	0.40697	0.02516	0.26512	0.21186	0.19518	0.23792	0.15038	0.22889
	0.29100	0.25837	0.16765	0.28232	0.30251	0.20407	0.17571	0.12247	0.23164	0.25050
	0.17049	0.16488	0.17977	0.16743	0.27629					

TABLE 5-5 (Continued)

J114	0.41238	0.27568	0.26182	0.32413	0.31609	0.15104	0.21249	0.31789	0.18667	0.22535
	0.36773	0.30566	0.25795	1.00000	0.25201	0.12669	0.12049	0.22405	0.22895	0.26300
	0.20900	0.25027	0.24000	0.16640	0.20463	0.23341	0.17402	0.31990	0.29481	0.24748
	0.30209	0.24225	0.31348	0.12856	0.31632	0.19414	0.29328	0.20463	0.27386	0.30927
	0.24276	0.31651	0.19093	0.34786	0.30765	0.35264	0.23146	0.30502	0.18155	0.32716
	0.25815	0.27287	0.11674	0.43397	0.29570					
J115	0.41056	0.27853	0.36242	0.35373	0.36300	0.24364	0.29084	0.44662	0.20073	0.33430
	0.40822	0.28159	0.26050	0.25201	1.00000	0.23207	0.14414	0.31233	0.37859	0.23641
	0.27262	0.28667	0.23220	0.34080	0.33131	0.26488	0.27878	0.39831	0.36745	0.09161
	0.48375	0.25818	0.34083	0.17634	0.39278	0.30622	0.33913	0.25121	0.22415	0.16826
	0.31950	0.37187	0.25396	0.44173	0.40959	0.27163	0.34450	0.24546	0.30429	0.18044
	0.18849	0.30033	0.07258	0.43746	0.41451					
J116	0.10827	0.18069	0.22497	0.19969	0.25139	0.27501	0.15821	0.31252	0.13181	0.11796
	0.22914	0.04621	0.15725	0.12669	0.23207	1.00000	0.11860	0.13189	0.23529	0.04060
	0.18672	0.11207	0.13342	0.24163	0.26362	0.08019	0.24244	0.21516	0.20270	0.10930
	0.26710	0.08330	0.26611	0.10992	0.27696	0.10473	0.21302	0.17758	0.14707	0.14980
	0.11258	0.19660	0.10674	0.21925	0.16172	0.13088	0.14985	0.19200	0.19294	0.10141
	0.18229	0.12980	0.15552	0.21411	0.19530					
J117	0.10115	0.19496	0.22868	0.15717	0.24167	0.23397	0.11978	0.18635	0.13657	0.24586
	0.18871	0.13193	0.19161	0.12049	0.14414	0.11860	1.00000	0.18826	0.18962	0.11998
	0.12712	0.13011	0.11742	0.18282	0.11691	0.15937	0.21105	0.17364	0.30674	0.22992
	0.12704	0.10844	0.21720	0.0	0.30891	0.11122	0.19984	0.12894	0.14145	0.28267
	0.17888	0.25571	0.0	0.15746	0.19496	0.12059	0.10234	0.0	0.11314	0.13800
	0.10813	0.18436	0.08196	0.21085	0.19123					
J118	0.30170	0.25638	0.36420	0.24053	0.25397	0.15257	0.30982	0.11513	0.22954	0.24232
	0.38888	0.22898	0.29228	0.22405	0.31233	0.13189	0.18826	1.00000	0.27544	0.08921
	0.23684	0.33980	0.21378	0.23396	0.30673	0.16281	0.24064	0.28650	0.38464	0.02964
	0.30395	0.17216	0.17289	0.19595	0.31104	0.19374	0.16917	0.23352	0.25404	0.12875
	0.10940	0.26088	0.17997	0.21836	0.34895	0.32409	0.25626	0.19178	0.24842	0.21098
	0.15902	0.14186	0.08743	0.27590	0.36816					
J119	0.24789	0.24492	0.22347	0.32057	0.33025	0.39619	0.31161	0.29577	0.22336	0.27613
	0.36003	0.26138	0.33101	0.22895	0.37859	0.23529	0.18962	0.27544	1.00000	0.23252
	0.28653	0.17217	0.25665	0.37190	0.30620	0.20337	0.29188	0.21332	0.31360	0.06720
	0.42308	0.23837	0.29082	0.10755	0.33296	0.24604	0.31133	0.15932	0.11782	0.17648
	0.22932	0.19532	0.14077	0.29063	0.36530	0.18769	0.19785	0.23773	0.19248	0.28582
	0.15998	0.18978	0.04783	0.27007	0.24341					
J120	0.17085	0.08870	0.13660	0.12947	0.13519	0.04769	0.11346	0.09096	0.09710	0.07026
	0.20238	0.09441	0.16131	0.26300	0.23641	0.04060	0.11998	0.08921	0.23252	1.00000
	0.08053	0.16036	0.16185	0.13704	0.08067	0.14804	0.09082	0.19324	0.11827	0.12574
	0.24059	0.12506	0.12040	0.05850	0.16674	0.16257	0.16859	0.09278	0.05089	0.13705
	0.20136	0.14277	0.15085	0.27529	0.15007	0.25652	0.10441	0.08644	0.09640	0.11600
	0.10345	0.17493	0.12505	0.24404	0.16602					

TABLE 5-5 (Continued)

J121	0.28498	0.27005	0.20870	0.24170	0.29810	0.16951	0.19877	0.27955	0.16344	0.21413
	0.30082	0.16739	0.24081	0.20900	0.27262	0.18672	0.12712	0.23684	0.28653	0.08053
	1.00000	0.16315	0.23029	0.26220	0.15035	0.18275	0.24781	0.28103	0.31836	0.21538
	0.33018	0.16696	0.22443	0.12711	0.31063	0.18217	0.28844	0.18951	0.20917	0.21694
	0.20422	0.24092	0.16639	0.27236	0.27273	0.13178	0.17717	0.24030	0.19672	0.14877
	0.06747	0.16582	0.06697	0.23594	0.26813					
J122	0.26612	0.22062	0.24935	0.23749	0.27993	0.20257	0.23987	0.37888	0.15538	0.30197
	0.43076	0.20785	0.22810	0.25027	0.28667	0.11207	0.13011	0.33980	0.17217	0.16036
	0.16315	1.00000	0.31542	0.18708	0.24764	0.16124	0.22901	0.30502	0.25241	0.16497
	0.33690	0.23653	0.19648	0.18533	0.27791	0.13804	0.15961	0.07297	0.20442	0.24402
	0.26922	0.22600	0.12912	0.24162	0.25421	0.25323	0.14632	0.23717	0.23780	0.18704
	0.10887	0.23427	0.09686	0.25734	0.31274					
J123	0.35337	0.11891	0.38642	0.29589	0.22910	0.19162	0.23634	0.26652	0.11748	0.28361
	0.29071	[illegible]	0.24109	0.24000	0.23220	0.13342	0.11742	0.21378	0.25665	0.16185
	0.23029	0.31542	1.00000	0.18699	0.21319	0.17147	0.25460	0.20743	0.23943	0.10428
	0.37902	0.17790	0.25676	0.12443	0.32410	0.19918	0.29377	0.17196	0.19042	0.19163
	0.14763	0.31843	0.18704	0.25148	0.29052	0.05023	0.25889	0.26025	0.26611	0.27407
	0.08067	0.13627	0.10811	0.35223	0.23526					
J124	0.30091	0.22486	0.26607	0.32421	0.28829	0.14858	0.31750	0.38822	0.21577	0.17672
	0.39165	0.26464	0.18516	0.16640	0.34088	0.24163	0.18282	0.23396	0.37190	0.13704
	0.26220	0.18708	0.18699	1.00000	0.24912	0.17315	0.38256	0.29780	0.27273	0.10787
	0.36782	0.12931	0.25786	0.12702	0.37952	0.17814	0.28660	0.16791	0.14685	0.15302
	0.13448	0.20623	0.14264	0.31250	0.32517	0.17498	0.21897	0.27252	0.23735	0.10116
	0.16224	0.16067	0.10620	0.34328	0.31917					
J125	0.22179	0.23874	0.34852	0.26304	0.22380	0.27441	0.25268	0.41225	0.23167	0.25418
	0.27795	0.24627	0.24314	0.20463	0.33131	0.26362	0.11691	0.30673	0.30620	0.08067
	0.15035	0.24764	0.21319	0.24912	1.00000	0.25568	0.23704	0.32566	0.28133	0.16237
	0.33207	0.17050	0.24042	0.05517	0.27483	0.05356	0.22476	0.13477	0.05230	0.20652
	0.15476	0.26353	0.14157	0.30395	0.34034	0.15559	0.21559	0.20316	0.16642	0.07089
	0.06878	0.05966	0.0	0.31466	0.13016					
J126	0.29616	0.12534	0.20407	0.32498	0.32957	0.23606	0.16091	0.21464	0.13910	0.24969
	0.34872	0.12038	0.18226	0.23341	0.26488	0.08019	0.15937	0.16281	0.20337	0.14804
	0.18275	0.16124	0.17147	0.17315	0.25568	1.00000	0.17831	0.32461	0.13654	0.16979
	0.22128	0.21350	0.28181	0.18210	0.26683	0.12272	0.24177	0.11369	0.15159	0.28394
	0.22407	0.29142	0.14039	0.23768	0.29413	0.18948	0.29291	0.17888	0.15677	0.13492
	0.09721	0.12393	0.06654	0.31946	0.24320					
J127	0.32307	0.21914	0.36412	0.23714	0.23853	0.21319	0.33629	0.40184	0.11509	0.19251
	0.38708	0.21514	0.30674	0.17402	0.27878	0.24244	0.21105	0.24064	0.29188	0.09082
	0.24781	0.22901	0.25460	0.38256	0.23704	0.17831	1.00000	0.36539	0.24094	0.11410
	0.35251	0.13214	0.24431	0.04895	0.28346	0.21080	0.23678	0.09069	0.11030	0.14501
	0.11489	0.24369	0.12298	0.26189	0.29640	0.03146	0.30083	0.23553	0.18693	0.28658
	0.18112	0.08532	0.08784	0.30286	0.21967					

TABLE 5-5 (Continued)

J128	0.41196	0.29098	0.40914	0.41057	0.40782	0.20040	0.31408	0.38467	0.19003	0.30240
	0.49329	0.27918	0.25529	0.31990	0.39831	0.21516	0.17364	0.28650	0.21332	0.19324
	0.28103	0.30502	0.20743	0.29780	0.32566	0.32461	0.36539	1.00000	0.33568	0.17941
	0.36509	0.22161	0.43798	0.21986	0.30675	0.20434	0.33729	0.17290	0.22646	0.30753
	0.22774	0.38867	0.19474	0.35843	0.43961	0.20824	0.26090	0.29280	0.29426	0.21415
	0.18978	0.18754	0.24010	0.40386	0.28102					
J129	0.35104	0.20666	0.27403	0.37698	0.39773	0.23384	0.31976	0.38065	0.08135	0.40160
	0.33595	0.18720	0.27674	0.29481	0.36745	0.20270	0.30674	0.38464	0.31360	0.11827
	0.31836	0.25241	0.23943	0.27273	0.28133	0.13654	0.24094	0.33568	1.00000	0.17791
	0.40416	0.32244	0.43971	0.20242	0.53346	0.17698	0.38200	0.25604	0.31838	0.33622
	0.33108	0.35699	0.18811	0.37774	0.45545	0.24371	0.23612	0.19733	0.23116	0.18054
	0.21323	0.34251	0.15177	0.37115	0.43637					
J130	0.17697	0.18698	0.12592	0.14477	0.27811	0.22951	0.16672	0.19478	0.13728	0.26607
	0.26235	0.13179	0.13231	0.24748	0.09161	0.10930	0.22992	0.02964	0.06720	0.12574
	0.21538	0.16497	0.10428	0.10787	0.16237	0.16979	0.11410	0.17941	0.17791	1.00000
	0.19959	0.06047	0.29090	0.14770	0.23993	0.10503	0.07932	0.05336	0.0	0.36474
	0.25821	0.19653	0.08775	0.16530	0.26935	0.0	0.03772	0.19344	0.08128	0.12169
	0.08645	0.24015	0.0	0.25082	0.21522					
J131	0.41732	0.28704	0.33368	0.34746	0.41186	0.26897	0.27793	0.41433	0.21000	0.35462
	0.41930	0.35070	0.30175	0.30209	0.48375	0.26710	0.12704	0.30395	0.42308	0.24059
	0.33018	0.33690	0.37902	0.36782	0.33207	0.22128	0.35251	0.36509	0.40416	0.19959
	1.00000	0.28767	0.31298	0.11669	0.31724	0.23522	0.51583	0.24723	0.25680	0.21238
	0.33045	0.37305	0.24248	0.48575	0.34742	0.24626	0.33433	0.29190	0.29921	0.21611
	0.17739	0.21370	0.08868	0.46748	0.40727					
J132	0.25297	0.17355	0.16632	0.19570	0.22375	0.18490	0.09383	0.25082	0.03619	0.11064
	0.26165	0.25021	0.20846	0.24225	0.25818	0.08330	0.10844	0.17216	0.23837	0.12506
	0.16696	0.23653	0.17790	0.12931	0.17050	0.21350	0.13214	0.22161	0.32244	0.06047
	0.28767	1.00000	0.29162	0.11936	0.20570	0.14899	0.26881	0.14693	0.14429	0.16775
	0.16188	0.26005	0.17745	0.19173	0.24485	0.24092	0.21727	0.10114	0.18894	0.24477
	0.22279	0.18145	0.06210	0.23397	0.30002					
J133	0.27088	0.30148	0.18727	0.39260	0.40366	0.15530	0.34322	0.50813	0.0	0.33105
	0.49849	0.31648	0.40697	0.31348	0.34083	0.26611	0.21720	0.17289	0.29082	0.12040
	0.22443	0.19648	0.25676	0.25786	0.24042	0.28181	0.24431	0.43798	0.43971	0.29090
	0.31298	0.29162	1.00000	0.12500	0.44739	0.23625	0.23948	0.23528	0.16927	0.48267
	0.18399	0.33519	0.18892	0.33558	0.46961	0.16295	0.14473	0.27288	0.24671	0.19285
	0.06851	0.20207	0.0	0.36090	0.21570					
J134	0.23282	0.15517	0.23758	0.12542	0.11593	0.05990	0.09937	0.09428	0.04800	0.10775
	0.19446	0.07637	0.02516	0.12856	0.17634	0.10992	0.0	0.19595	0.10755	0.05850
	0.12711	0.18533	0.12443	0.12702	0.05517	0.18210	0.04895	0.21986	0.20242	0.14770
	0.11669	0.11936	0.12500	1.00000	0.20540	0.11002	0.15179	0.15509	0.06275	0.14796
	0.14505	0.18624	0.12101	0.17388	0.19250	0.19270	0.17957	0.25859	0.14301	0.18425
	0.17912	0.20837	0.08320	0.22567	0.24308					

TABLE 5-5 (Continued)

J135	0.28907	0.27531	0.33274	0.36065	0.39351	0.28331	0.29201	0.48109	0.21358	0.40160
	0.46664	0.19771	0.26512	0.31632	0.39278	0.27696	0.30891	0.31104	0.33296	0.16674
	0.31063	0.27791	0.32410	0.37952	0.27483	0.26683	0.28346	0.30675	0.53346	0.23993
	0.31724	0.20570	0.44739	0.20540	1.00000	0.17023	0.28226	0.27339	0.21636	0.40200
	0.22766	0.41365	0.21571	0.34856	0.50045	0.19124	0.24477	0.25031	0.28531	0.24895
	0.18942	0.26884	0.19095	0.43382	0.36839					
J136	0.17383	0.09861	0.19019	0.25693	0.18305	0.15893	0.23296	0.28623	0.08312	0.07856
	0.28752	0.24680	0.21186	0.19414	0.30622	0.10473	0.11122	0.19374	0.24604	0.16257
	0.18217	0.13804	0.19918	0.17814	0.05356	0.12272	0.21080	0.20434	0.17698	0.10503
	0.23522	0.14899	0.23625	0.11002	0.17023	1.00000	0.16214	0.09354	0.02874	0.10346
	0.21151	0.10625	0.0	0.17436	0.21114	0.11555	0.12160	0.16559	0.15373	0.12616
	0.12453	0.17790	0.0	0.26466	0.16850					
J137	0.33124	0.29579	0.28462	0.31862	0.34411	0.30218	0.21356	0.31035	0.05303	0.30840
	0.40033	0.25671	0.19518	0.29328	0.33913	0.21302	0.19984	0.16917	0.31133	0.16859
	0.28844	0.15961	0.29377	0.28660	0.22476	0.24177	0.23678	0.33729	0.38200	0.07932
	0.51583	0.26881	0.23948	0.15179	0.28226	0.16214	1.00000	0.29200	0.28991	0.30807
	0.20735	0.38675	0.22786	0.35762	0.42002	0.25700	0.27690	0.25557	0.19138	0.22824
	0.16311	0.16904	0.19869	0.37773	0.32348					
J139	0.18293	0.23516	0.20189	0.22096	0.30141	0.19954	0.15641	0.13553	0.12973	0.27039
	0.13212	0.11048	0.23792	0.20463	0.25121	0.17758	0.12894	0.23352	0.15932	0.09278
	0.18951	0.07297	0.17196	0.16791	0.13477	0.11369	0.09069	0.17290	0.25604	0.05336
	0.24723	0.14693	0.23528	0.15509	0.27339	0.09354	0.29200	1.00000	0.16917	0.19714
	0.13326	0.24042	0.18021	0.16515	0.21414	0.14516	0.20542	0.22342	0.15829	0.23366
	0.19805	0.24738	0.18187	0.24243	0.32714					
J140	0.18859	0.20962	0.18978	0.07251	0.28357	0.09121	0.16495	0.21231	0.17916	0.23907
	0.29698	0.06551	0.15038	0.27386	0.22415	0.14707	0.14145	0.25404	0.11782	0.05089
	0.20917	0.20442	0.19042	0.14685	0.05230	0.15159	0.11030	0.22646	0.31838	0.0
	0.25680	0.14429	0.16927	0.06275	0.21636	0.02874	0.28991	0.16917	1.00000	0.11785
	0.17707	0.24367	0.64064	0.28476	0.15240	0.16105	0.21451	0.20129	0.21001	0.14348
	0.05209	0.10665	0.0	0.27834	0.23768					
J141	0.25425	0.25229	0.20981	0.33079	0.31226	0.20420	0.22641	0.33403	0.13328	0.47275
	0.40603	0.17846	0.22889	0.30927	0.16826	0.14980	0.28267	0.12875	0.17648	0.13705
	0.21694	0.24402	0.19163	0.15302	0.20652	0.28394	0.14501	0.30753	0.33622	0.36474
	0.21238	0.16775	0.48267	0.14796	0.40200	0.10346	0.30807	0.19714	0.11785	1.00000
	0.32183	0.29720	0.12499	0.24177	0.37306	0.12547	0.09708	0.19163	0.20668	0.09747
	0.0	0.33495	0.22304	0.31786	0.25772					
J142	0.27917	0.18193	0.21874	0.25548	0.28904	0.24516	0.20428	0.18594	0.14266	0.24825
	0.26097	0.13927	0.29100	0.24276	0.31950	0.11258	0.17888	0.10940	0.22932	0.20136
	0.20422	0.26922	0.14763	0.13448	0.15476	0.22407	0.11489	0.22774	0.33108	0.25821
	0.33045	0.16188	0.18399	0.14505	0.22766	0.21151	0.20735	0.13326	0.17707	0.32183
	1.00000	0.30228	0.10904	0.22830	0.27880	0.30287	0.18092	0.22037	0.23534	0.22871
	0.16394	0.21856	0.0	0.29906	0.27739					

TABLE 5-5 (Continued)

J143	0.32995	0.31944	0.25807	0.30614	0.35195	0.27060	0.25931	0.35370	0.14281	0.30468
	0.39801	0.24174	0.25837	0.31651	0.37187	0.19660	0.25571	0.26088	0.19532	0.14277
	0.24092	0.22600	0.31843	0.20623	0.26353	0.29142	0.24369	0.38867	0.35699	0.19653
	0.37305	0.26005	0.33519	0.18624	0.41365	0.10625	0.38675	0.24042	0.24367	0.29720
	0.30228	1.00000	0.21972	0.38730	0.32319	0.23554	0.27404	0.24892	0.28685	0.21422
	0.22333	0.25101	0.10722	0.34149	0.35933					
J144	0.26562	0.14041	0.14719	0.16709	0.18740	0.08533	0.09870	0.17812	0.17360	0.23106
	0.25324	0.05547	0.16765	0.19093	0.25396	0.10674	0.0	0.17997	0.14077	0.15085
	0.16639	0.12912	0.18704	0.14264	0.14157	0.14039	0.12298	0.19474	0.18811	0.08775
	0.24248	0.17745	0.18892	0.12101	0.21571	0.0	0.22786	0.18021	0.64064	0.12499
	0.10904	0.21972	1.00000	0.24170	0.18086	0.11818	0.20396	0.28260	0.21739	0.14854
	0.13612	0.20601	0.04427	0.24051	0.15793					
J145	0.33467	0.28241	0.20593	0.33730	0.37501	0.29660	0.24559	0.52473	0.19348	0.28809
	0.44287	0.31002	0.28232	0.34786	0.44173	0.21925	0.15746	0.21836	0.29063	0.27529
	0.27236	0.24162	0.25148	0.31250	0.30395	0.23768	0.26189	0.35843	0.37774	0.16530
	0.48575	0.19173	0.33558	0.17388	0.34856	0.17436	0.35762	0.16515	0.28476	0.24177
	0.22830	0.38730	0.24170	1.00000	0.29924	0.15148	0.32319	0.41905	0.36531	0.29461
	0.25577	0.28920	0.06249	0.31389	0.39920					
J146	0.39184	0.24416	0.38369	0.43372	0.43003	0.27384	0.37316	0.41778	0.18594	0.48460
	0.44083	0.30341	0.30251	0.30765	0.40959	0.16172	0.19496	0.34895	0.36530	0.15007
	0.27273	0.25421	0.29052	0.32517	0.34034	0.29413	0.29640	0.43961	0.45545	0.26935
	0.34742	0.24485	0.46961	0.19250	0.50045	0.21114	0.42002	0.21414	0.15240	0.37306
	0.27880	0.32319	0.18086	0.29924	1.00000	0.26445	0.26241	0.23249	0.32094	0.26630
	0.17889	0.26710	0.12202	0.39181	0.32767					
J147	0.26608	0.20532	0.16622	0.25675	0.23939	0.15284	0.24477	0.16518	0.10596	0.08262
	0.22931	0.23901	0.20407	0.35264	0.27163	0.13088	0.12059	0.32409	0.18769	0.25652
	0.13178	0.25323	0.05023	0.17498	0.15559	0.18948	0.03146	0.20824	0.24371	0.0
	0.24626	0.24092	0.16295	0.19270	0.19124	0.11555	0.25700	0.14516	0.16105	0.12547
	0.30287	0.23554	0.11818	0.15148	0.26445	1.00000	0.20298	0.12776	0.14227	0.16507
	0.27413	0.19470	0.22060	0.40295	0.36069					
J148	0.30593	0.21318	0.29989	0.14977	0.22455	0.09620	0.25184	0.28929	0.13237	0.24220
	0.27728	0.24748	0.17571	0.23146	0.34450	0.14985	0.10234	0.25626	0.19785	0.10441
	0.17717	0.14632	0.25889	0.21897	0.21559	0.29291	0.30083	0.26090	0.23612	0.03772
	0.33433	0.21727	0.14473	0.17957	0.24477	0.12160	0.27690	0.20542	0.21451	0.09708
	0.18092	0.27404	0.20396	0.32319	0.26241	0.20298	1.00000	0.20458	0.21693	0.24626
	0.15209	0.20964	0.17376	0.33810	0.33199					
J149	0.22554	0.26038	0.23038	0.27139	0.21483	0.18986	0.21071	0.32300	0.20065	0.25461
	0.33430	0.14965	0.12247	0.30502	0.24546	0.19200	0.0	0.19178	0.23773	0.08644
	0.24030	0.23717	0.26025	0.27252	0.20316	0.17888	0.23553	0.29280	0.19733	0.19344
	0.29190	0.10114	0.27288	0.25859	0.25031	0.16559	0.25557	0.22342	0.20129	0.19163
	0.22037	0.24892	0.28260	0.41905	0.23249	0.12776	0.20458	1.00000	0.21535	0.11287
	0.15548	0.24598	0.10954	0.25488	0.25786					

TABLE 5-5 (Continued)

J150	0.32048	0.22078	0.23544	0.20638	0.27306	0.22531	0.20921	0.33827	0.21071	0.25399
	0.30632	0.18757	0.23164	0.18155	0.30429	0.19294	0.11314	0.24842	0.19248	0.09640
	0.19672	0.23780	0.26611	0.23735	0.16642	0.15677	0.18693	0.29426	0.23116	0.08128
	0.29921	0.18894	0.24671	0.14301	0.28531	0.15373	0.19138	0.15829	0.21001	0.20668
	0.23534	0.28685	0.21739	0.36531	0.32094	0.14227	0.21693	0.21535	1.00000	0.24536
	0.11369	0.21868	0.09721	0.28590	0.24682					
J151	0.36767	0.20238	0.21631	0.28149	0.22244	0.15927	0.12110	0.21229	0.12203	0.06866
	0.43459	0.24104	0.25050	0.32716	0.18044	0.10141	0.13800	0.21098	0.28582	0.11600
	0.14877	0.18704	0.27407	0.10116	0.07089	0.13492	0.28658	0.21415	0.18054	0.12169
	0.21611	0.24477	0.19285	0.18425	0.24895	0.12616	0.22824	0.23366	0.14348	0.09747
	0.22871	0.21422	0.14854	0.29461	0.26630	0.16507	0.24626	0.11287	0.24536	1.00000
	0.27145	0.20005	0.09034	0.36964	0.38954					
J152	0.20212	0.19437	0.23761	0.15200	0.08615	0.12626	0.12033	0.16262	0.09904	0.08803
	0.18757	[illegible]	0.17049	0.25815	0.18849	0.18229	0.10813	0.15902	0.15998	0.10345
	0.06747	0.10887	0.08067	0.16224	0.06878	0.09721	0.18112	0.18978	0.21323	0.08645
	0.17739	0.22279	0.06851	0.17912	0.18942	0.12453	0.16311	0.19805	0.05209	0.0
	0.16394	0.22333	0.13612	0.25577	0.17889	0.27413	0.15209	0.15548	0.11369	0.27145
	1.00000	0.22674	0.18008	0.25111	0.25376					
J153	0.25670	0.06023	0.01170	0.25177	0.34016	0.17371	0.23199	0.17956	0.06880	0.34082
	0.23415	0.03851	0.16488	0.27287	0.30033	0.12980	0.18436	0.14186	0.18978	0.17493
	0.16582	0.23427	0.13627	0.16067	0.05966	0.12393	0.08532	0.18754	0.34251	0.24015
	0.21370	0.18145	0.20207	0.20837	0.26884	0.17790	0.16904	0.24738	0.10665	0.33495
	0.21856	0.25101	0.20601	0.28920	0.26710	0.19470	0.20964	0.24598	0.21368	0.20005
	0.22674	1.00000	0.18219	0.34618	0.26838					
J154	0.12231	0.04128	0.08639	0.11713	0.16381	0.05026	0.07357	0.26073	0.0	0.0
	0.09266	0.06170	0.17977	0.11674	0.07258	0.15552	0.08196	0.08743	0.04783	0.12505
	0.06697	0.09686	0.10811	0.10620	0.0	0.06654	0.08784	0.24010	0.15177	0.0
	0.08868	0.06210	0.0	0.08320	0.19095	0.0	0.19869	0.18187	0.0	0.22304
	0.0	0.10722	0.04427	0.06249	0.12202	0.22060	0.17376	0.10954	0.09721	0.09034
	0.18008	0.18219	1.00000	0.18318	0.16472					
J155	0.50233	0.13424	0.36941	0.41511	0.35953	0.26586	0.27923	0.27832	0.07630	0.31906
	0.35113	0.23069	0.16743	0.43397	0.43746	0.21411	0.21085	0.27590	0.27007	0.24404
	0.23594	0.25734	0.35223	0.34328	0.31466	0.31946	0.30286	0.40386	0.37115	0.25082
	0.46748	0.23397	0.36090	0.22567	0.43382	0.26466	0.37773	0.24243	0.27834	0.31786
	0.29906	0.34149	0.24051	0.31389	0.39181	0.40295	0.33810	0.25488	0.28590	0.36964
	0.25111	0.34618	0.18318	1.00000	0.46901					
J156	0.40676	0.17818	0.29599	0.21442	0.32183	0.18373	0.26611	0.18057	0.21518	0.26012
	0.34134	0.21416	0.27629	0.29570	0.41451	0.19530	0.19123	0.36816	0.24341	0.16602
	0.26813	0.31274	0.23526	0.31917	0.13016	0.24320	0.21967	0.28102	0.43637	0.21522
	0.40727	0.30002	0.21570	0.24308	0.36839	0.16850	0.32348	0.32714	0.23768	0.25772
	0.27739	0.35933	0.15793	0.39920	0.32767	0.36069	0.33199	0.25786	0.24682	0.38954
	0.25376	0.26838	0.16472	0.46901	1.00000					

TABLE 5-6

Tetrachoric Correlation Matrix of the Fifty-Five Item Response Tendencies of Test J1 in the J1/2259 Case.

	J101	J102	J103	J104	J105	J106	J107	J108	J109	J110
	J111	J112	J113	J114	J115	J116	J117	J118	J119	J120
	J121	J122	J123	J124	J125	J126	J127	J128	J129	J130
	J131	J132	J133	J134	J135	J136	J137	J139	J140	J141
	J142	J143	J144	J145	J146	J147	J148	J149	J150	J151
	J152	J153	J154	J155	J156					
J101	1.00000	0.32878	0.33142	0.27233	0.36527	0.23930	0.25433	0.28207	0.25357	0.20154
	0.44109	0.30687	0.25598	0.25899	0.35874	0.13501	0.16455	0.31979	0.25637	0.17382
	0.26701	0.27938	0.30775	0.22350	0.21587	0.19550	0.27860	0.33976	0.34834	0.16264
	0.39523	0.15432	0.29977	0.23934	0.32843	0.18602	0.30441	0.16192	0.22883	0.24048
	0.20900	0.26363	0.24065	0.33405	0.36443	0.19770	0.30278	0.21787	0.27089	0.27333
	0.22068	0.15374	0.08216	0.44011	0.35716					
J102	0.32878	1.00000	0.25744	0.29398	0.31323	0.27692	0.22315	0.34279	0.17459	0.21537
	0.36948	0.21190	0.22886	0.16958	0.28203	0.17924	0.19360	0.31720	0.22714	0.15051
	0.22386	0.17091	0.18226	0.26193	0.18780	0.14647	0.17569	0.30612	0.22842	0.15818
	0.28004	0.15986	0.32263	0.15234	0.29703	0.13125	0.22780	0.19857	0.13798	0.15917
	0.13424	0.25861	0.14061	0.23948	0.26860	0.11470	0.19364	0.20211	0.27458	0.20833
	0.17808	0.05059	0.09907	0.17276	0.20069					
J103	0.33142	0.25744	1.00000	0.29043	0.22569	0.29332	0.27870	0.26929	0.19894	0.26395
	0.31830	0.23922	0.21887	0.19483	0.32117	0.21294	0.17885	0.37334	0.21838	0.10776
	0.22921	0.23554	0.25229	0.25574	0.26041	0.13096	0.27447	0.34302	0.26709	0.12394
	0.29851	0.13316	0.22007	0.18540	0.30940	0.17912	0.19937	0.20954	0.16755	0.13751
	0.17154	0.22286	0.15881	0.21545	0.30422	0.09800	0.21892	0.22128	0.16487	0.21465
	0.16324	0.07617	0.13251	0.28797	0.26846					
J104	0.27233	0.29398	0.29043	1.00000	0.39883	0.31907	0.36837	0.31992	0.24911	0.30267
	0.34721	0.20428	0.27708	0.27711	0.28433	0.13762	0.19176	0.29315	0.37348	0.11671
	0.22498	0.21369	0.26077	0.29045	0.29474	0.21978	0.26971	0.38054	0.34684	0.18866
	0.35477	0.15407	0.43199	0.12502	0.37596	0.23601	0.30466	0.19580	0.15284	0.33623
	0.29254	0.25167	0.12727	0.23514	0.41563	0.18405	0.19656	0.30094	0.22374	0.20047
	0.21615	0.19910	0.12740	0.31191	0.23505					
J105	0.36527	0.31323	0.22569	0.39883	1.00000	0.30991	0.34336	0.40032	0.26986	0.35883
	0.45612	0.23763	0.28128	0.26241	0.30027	0.16277	0.27616	0.26098	0.32569	0.14302
	0.26217	0.21015	0.21113	0.32009	0.21887	0.22925	0.27605	0.33256	0.39452	0.25486
	0.35614	0.13377	0.41424	0.10697	0.40355	0.20881	0.32481	0.22164	0.28243	0.32547
	0.24058	0.32786	0.22472	0.29897	0.43677	0.20639	0.24142	0.24620	0.31215	0.21091
	0.15990	0.24051	0.22750	0.39625	0.36754					
J106	0.23930	0.27692	0.29332	0.31907	0.30991	1.00000	0.21231	0.26363	0.21671	0.27603
	0.29502	0.19027	0.24077	0.12964	0.21712	0.16374	0.19719	0.21194	0.32772	0.01639
	0.19895	0.13890	0.20067	0.14805	0.25926	0.16085	0.17443	0.19679	0.20856	0.22147
	0.26351	0.15887	0.24655	0.05390	0.30965	0.17535	0.24218	0.17377	0.14348	0.16832
	0.20358	0.23799	0.11370	0.21841	0.26008	0.07512	0.14409	0.19499	0.19201	0.14742
	0.11725	0.20108	0.08912	0.21864	0.20874					

TABLE 5-6 (Continued)

J107	0.25433	0.22315	0.27870	0.36837	0.34336	0.21231	1.00000	0.27784	0.24037	0.28396
	0.30830	0.14291	0.25336	0.18064	0.23108	0.16250	0.16042	0.27873	0.36437	0.07921
	0.17741	0.19873	0.16130	0.36686	0.23335	0.15881	0.31874	0.23400	0.35473	0.13672
	0.28634	0.13519	0.34570	0.06630	0.33735	0.22421	0.24195	0.18167	0.18195	0.24148
	0.16667	0.21866	0.12525	0.14786	0.42737	0.22039	0.22579	0.23125	0.23282	0.13768
	0.14747	0.17926	0.10483	0.27648	0.30746					
J108	0.28207	0.34279	0.26929	0.31992	0.40032	0.26363	0.27784	1.00000	0.14605	0.24479
	0.42276	0.23951	0.27054	0.25802	0.36545	0.27495	0.25173	0.14620	0.24056	0.18819
	0.26281	0.29821	0.25560	0.28728	0.25657	0.25432	0.32762	0.34936	0.36361	0.22637
	0.35007	0.20079	0.42225	0.11014	0.41884	0.27501	0.24471	0.12418	0.21784	0.33301
	0.22206	0.32157	0.23348	0.44349	0.39355	0.14182	0.32500	0.27689	0.29693	0.25023
	0.15689	0.17722	0.21716	0.28132	0.23489					
J109	0.25357	0.17459	0.19894	0.24911	0.26986	0.21671	0.24037	0.14605	1.00000	0.19502
	0.29407	0.14462	0.09173	0.14285	0.17570	0.07347	0.14721	0.25028	0.31049	0.09826
	0.15980	0.15639	0.17222	0.24806	0.19831	0.09477	0.20105	0.15462	0.17544	0.13319
	0.22427	0.04003	0.19625	0.06872	0.25135	0.08832	0.14591	0.12897	0.13597	0.13506
	0.08800	0.09323	0.08599	0.11783	0.21396	0.09231	0.18190	0.19272	0.19163	0.13087
	0.15005	0.0	0.0	0.12347	0.26572					
J110	0.20154	0.21537	0.26395	0.30267	0.35883	0.27603	0.28396	0.24479	0.19502	1.00000
	0.34715	0.10876	0.17541	0.18712	0.24057	0.07868	0.23930	0.15953	0.27441	0.08441
	0.16808	0.23478	0.20961	0.23219	0.19382	0.20060	0.15502	0.22003	0.31175	0.23563
	0.23766	0.04709	0.28349	0.05018	0.39802	0.16685	0.19084	0.28835	0.18384	0.43748
	0.25913	0.24541	0.14203	0.21089	0.42511	0.03832	0.20739	0.27424	0.22393	0.13608
	0.10603	0.32331	0.05963	0.31022	0.21264					
J111	0.44109	0.36948	0.31830	0.34721	0.45612	0.29502	0.30830	0.42276	0.29407	0.34715
	1.00000	0.33203	0.25644	0.29944	0.39185	0.15326	0.21980	0.38704	0.35815	0.22610
	0.30293	0.31310	0.26753	0.34079	0.27374	0.28111	0.35573	0.42995	0.37403	0.19589
	0.42603	0.20111	0.47531	0.17264	0.44115	0.24768	0.38724	0.15171	0.25987	0.33938
	0.22705	0.32337	0.25778	0.40524	0.42631	0.16991	0.34050	0.32743	0.28496	0.33624
	0.26151	0.13547	0.11726	0.31467	0.30765					
J112	0.30687	0.21190	0.23922	0.20428	0.23763	0.19027	0.14291	0.23951	0.14462	0.10876
	0.33203	1.00000	0.16712	0.18685	0.23806	0.07220	0.12531	0.27621	0.23957	0.07077
	0.16608	0.20443	0.13270	0.18413	0.17685	0.09405	0.19319	0.23735	0.15875	0.11378
	0.33084	0.16503	0.30844	0.13499	0.19655	0.14877	0.20481	0.09837	0.08667	0.12883
	0.13857	0.19689	0.10543	0.27379	0.25177	0.19275	0.20485	0.15949	0.15550	0.17349
	0.24092	0.01806	0.03083	0.18573	0.19613					
J113	0.25598	0.22886	0.21887	0.27708	0.28128	0.24077	0.25336	0.27054	0.09173	0.17541
	0.25644	0.16712	1.00000	0.23361	0.25438	0.12733	0.13086	0.29373	0.2800[illegible]	0.10190
	0.24144	0.21350	0.22188	0.21431	0.19665	0.16169	0.23829	0.27671	0.2500[illegible]	0.08777
	0.27066	0.12520	0.36584	0.12794	0.27203	0.15859	0.15876	0.17976	0.1512[illegible]	0.19860
	0.20395	0.19295	0.16608	0.20729	0.27686	0.13608	0.20758	0.17889	0.19742	0.24099
	0.17705	0.14128	0.15630	0.15045	0.23394					

TABLE 5-6 (Continued)

J114	0.25899	0.16958	0.19483	0.27711	0.26241	0.12964	0.18064	0.25802	0.14285	0.18712
	0.29944	0.18685	0.23361	1.00000	0.22788	0.07992	0.08776	0.17771	0.18293	0.21394
	0.14379	0.19305	0.18617	0.17193	0.17029	0.16577	0.11032	0.23014	0.19787	0.16615
	0.22843	0.14648	0.28086	0.12639	0.25131	0.11672	0.22922	0.17134	0.24155	0.25380
	0.17281	0.22546	0.14987	0.23806	0.27564	0.22046	0.18024	0.21628	0.17460	0.21402
	0.20080	0.23034	0.11722	0.30724	0.20630					
J115	0.35874	0.28203	0.32117	0.28433	0.30027	0.21712	0.23108	0.36545	0.17570	0.24057
	0.39185	0.23806	0.25438	0.22788	1.00000	0.16033	0.18686	0.27299	0.32088	0.20010
	0.23261	0.23216	0.20813	0.29486	0.24404	0.20993	0.21009	0.36513	0.32673	0.07875
	0.44083	0.20370	0.35140	0.16821	0.33462	0.29106	0.29441	0.17413	0.18212	0.16105
	0.26324	0.31606	0.18755	0.37591	0.34045	0.20229	0.30099	0.21082	0.27751	0.23827
	0.18383	0.23861	0.11608	0.38895	0.34037					
J115	0.13501	0.17924	0.21294	0.13762	0.16277	0.16374	0.16250	0.27495	0.07347	0.07868
	0.15326	0.07220	0.12733	0.07992	0.16033	1.00000	0.09137	0.15176	0.18260	0.0
	0.17948	0.09866	0.09411	0.21735	0.13678	0.07698	0.12106	0.20224	0.23410	0.07683
	0.19817	0.06611	0.16734	0.08052	0.21932	0.06355	0.08741	0.11501	0.09959	0.08683
	0.08260	0.15879	0.09599	0.16033	0.15846	0.05560	0.18165	0.10337	0.15461	0.09722
	0.11712	0.11474	0.10984	0.17262	0.13721					
J117	0.16455	0.19360	0.17885	0.19176	0.27616	0.19719	0.16042	0.25173	0.14721	0.23930
	0.21980	0.12531	0.13086	0.08776	0.18686	0.09137	1.00000	0.17751	0.21416	0.09124
	0.13514	0.13813	0.11486	0.10339	0.14152	0.09807	0.15632	0.17866	0.24670	0.23093
	0.13875	0.11395	0.25244	0.03099	0.30148	0.07023	0.18115	0.15940	0.16099	0.32507
	0.19004	0.22771	0.06333	0.16711	0.24075	0.10858	0.14551	0.10594	0.18375	0.11590
	0.14225	0.18862	0.06820	0.19707	0.14728					
J118	0.31979	0.31720	0.37334	0.29315	0.26098	0.21194	0.27873	0.14620	0.25028	0.15953
	0.38704	0.27621	0.29373	0.17771	0.27299	0.15176	0.17751	1.00000	0.30917	0.14337
	0.22924	0.26948	0.19321	0.18322	0.24996	0.12067	0.29364	0.31691	0.37578	0.08011
	0.37381	0.17603	0.21984	0.24208	0.31477	0.19965	0.13113	0.16916	0.22172	0.07863
	0.18901	0.17150	0.14844	0.25302	0.30880	0.25069	0.30975	0.19457	0.23405	0.20069
	0.17846	0.0	0.04572	0.22707	0.33100					
J119	0.25637	0.22714	0.21838	0.37348	0.32569	0.32772	0.36437	0.24056	0.31049	0.27441
	0.35815	0.23957	0.28005	0.18293	0.32088	0.18260	0.21416	0.30917	1.00000	0.16613
	0.24679	0.20696	0.23759	0.34858	0.26573	0.11877	0.32507	0.22300	0.34414	0.10955
	0.38984	0.17723	0.31096	0.14381	0.33959	0.27045	0.26995	0.15896	0.15868	0.17015
	0.22872	0.21688	0.11599	0.21882	0.38464	0.14742	0.23838	0.28662	0.22880	0.24063
	0.21557	0.14871	0.08792	0.28325	0.29952					
J120	0.17382	0.15051	0.10776	0.11671	0.14302	0.01639	0.07921	0.18819	0.09826	0.08441
	0.22610	0.07077	0.10190	0.21394	0.20010	0.0	0.09124	0.14337	0.16613	1.00000
	0.08931	0.16613	0.14348	0.14658	0.04695	0.12609	0.13668	0.16621	0.15922	0.11207
	0.21911	0.12013	0.15776	0.09463	0.19574	0.10586	0.14327	0.09745	0.09856	0.12308
	0.08885	0.18218	0.16400	0.25024	0.11525	0.13601	0.12167	0.06122	0.13790	0.13285
	0.12682	0.08253	0.05798	0.14630	0.14222					

TABLE 5-6 (Continued)

J121	0.26701	0.22386	0.22921	0.22498	0.26217	0.19895	0.17741	0.26281	0.15980	0.16808
	0.30293	0.16608	0.24144	0.14379	0.23261	0.17948	0.13514	0.22924	0.24679	0.08931
	1.00000	0.14822	0.18051	0.23476	0.19684	0.15852	0.16705	0.27026	0.26302	0.17480
	0.24744	0.13178	0.24492	0.15584	0.30938	0.16325	0.21457	0.20861	0.16478	0.18777
	0.18000	0.24304	0.11680	0.20554	0.27084	0.07858	0.23123	0.22511	0.20477	0.17525
	0.09386	0.11705	0.03879	0.17564	0.25124					
J122	0.27938	0.17091	0.23554	0.21369	0.21015	0.13890	0.19873	0.29821	0.15639	0.23478
	0.31310	0.20443	0.21350	0.19305	0.23216	0.09866	0.13813	0.26948	0.20696	0.16613
	0.14822	1.00000	0.23010	0.17548	0.19285	0.09777	0.16559	0.25323	0.22268	0.15501
	0.28317	0.16255	0.20483	0.15391	0.22247	0.12006	0.16127	0.08797	0.14410	0.17181
	0.19407	0.17922	0.11943	0.19665	0.22290	0.17198	0.15208	0.21624	0.18696	0.19307
	0.11912	0.18774	0.08175	0.20634	0.22787					
J123	0.30775	0.18226	0.25229	0.26077	0.21113	0.20067	0.16130	0.25560	0.17222	0.20961
	0.26753	0.13270	0.22188	0.18617	0.20813	0.09411	0.11486	0.19321	0.23759	0.14348
	0.18051	0.23010	1.00000	0.18694	0.17000	0.13629	0.19957	0.25189	0.22196	0.10383
	0.32267	0.08987	0.24730	0.10662	0.27183	0.18694	0.22461	0.11801	0.18303	0.1922[illegible]
	0.13617	0.18347	0.15809	0.23374	0.26506	0.07150	0.21101	0.19376	0.20994	0.22978
	0.12436	0.12239	0.08128	0.25847	0.21100					
J124	0.22350	0.26193	0.25574	0.29045	0.32009	0.14805	0.36686	0.28728	0.24806	0.23219
	0.34079	0.18413	0.21431	0.17193	0.29486	0.21735	0.10339	0.18322	0.34858	0.14658
	0.23476	0.17548	0.18694	1.00000	0.21060	0.09607	0.30612	0.27290	0.32963	0.10086
	0.25929	0.09877	0.24908	0.14339	0.33303	0.13512	0.25599	0.18122	0.16942	0.19556
	0.06978	0.23359	0.14090	0.21475	0.35273	0.17852	0.21528	0.22483	0.22865	0.16921
	0.14340	0.17997	0.09809	0.31173	0.29452					
J125	0.21587	0.18780	0.26041	0.29474	0.21887	0.25926	0.23335	0.25657	0.19831	0.19382
	0.27374	0.17685	0.19665	0.17029	0.24404	0.13678	0.14152	0.24996	0.26573	0.04695
	0.19684	0.19285	0.17000	0.21060	1.00000	0.14414	0.18841	0.23249	0.21926	0.11469
	0.28249	0.08750	0.28976	0.10011	0.33479	0.08492	0.18027	0.10161	0.11273	0.19822
	0.09911	0.20644	0.15297	0.21972	0.30816	0.06034	0.20784	0.19402	0.11619	0.08219
	0.09979	0.07949	0.03311	0.23501	0.16628					
J126	0.19550	0.14647	0.13096	0.21978	0.22925	0.16085	0.15881	0.25432	0.09477	0.20060
	0.28111	0.09405	0.16169	0.16577	0.20993	0.07698	0.09807	0.12067	0.11877	0.12609
	0.15852	0.09777	0.13629	0.09607	0.14414	1.00000	0.11030	0.23396	0.17336	0.07940
	0.18567	0.15703	0.23999	0.12204	0.22956	0.08941	0.18499	0.05259	0.14649	0.25681
	0.16946	0.20932	0.10244	0.17712	0.25528	0.08984	0.17516	0.14479	0.18517	0.15224
	0.10736	0.16118	0.0	0.23388	0.12261					
J127	0.27860	0.17569	0.27447	0.26971	0.27605	0.17443	0.31874	0.32762	0.20105	0.15502
	0.35573	0.19319	0.23829	0.11032	0.21009	0.12106	0.15632	0.29364	0.32507	0.13668
	0.16705	0.16559	0.19957	0.30612	0.18841	0.11030	1.00000	0.29571	0.24269	0.16406
	0.39992	0.12196	0.30306	0.06765	0.31400	0.18481	0.26615	0.09441	0.16295	0.13480
	0.12685	0.19284	0.15311	0.22816	0.28276	0.13533	0.23871	0.24867	0.20771	0.18030
	0.16340	0.0	0.07434	0.25315	0.29270					

TABLE 5-6 (Continued)

J128	0.33976	0.30612	0.34302	0.38054	0.33256	0.19679	0.23400	0.34936	0.15462	0.22003
	0.42995	0.23735	0.27671	0.23014	0.36513	0.20224	0.17866	0.31691	0.22300	0.16621
	0.27026	0.25323	0.25189	0.27290	0.23249	0.23396	0.29571	1.00000	0.26566	0.20944
	0.34207	0.18934	0.39398	0.22018	0.29566	0.19762	0.24486	0.15540	0.19334	0.27771
	0.20064	0.29057	0.22738	0.33406	0.33929	0.16378	0.23198	0.26730	0.30003	0.20921
	0.19437	0.10892	0.17452	0.31683	0.25591					
J129	0.34834	0.22842	0.26709	0.34684	0.39452	0.20856	0.35473	0.36361	0.17544	0.31175
	0.37403	0.15875	0.25009	0.19787	0.32673	0.23410	0.24670	0.37578	0.34414	0.15922
	0.26302	0.22268	0.22196	0.32963	0.21926	0.17336	0.24269	0.26566	1.00000	0.09298
	0.38685	0.25385	0.37280	0.18039	0.47290	0.16772	0.37928	0.24701	0.25089	0.28912
	0.26979	0.30165	0.14219	0.27176	0.47198	0.20604	0.27218	0.21873	0.23784	0.25906
	0.21095	0.27064	0.12969	0.35584	0.40009					
J130	0.16264	0.15818	0.12394	0.18866	0.25486	0.22147	0.13672	0.22637	0.13319	0.23563
	0.19589	0.11378	0.08777	0.16615	0.07875	0.07683	0.23093	0.08011	0.10955	0.11207
	0.17480	0.15501	0.10383	0.10086	0.11469	0.07940	0.16406	0.20944	0.09298	1.00000
	0.20916	0.05631	0.29100	0.10049	0.23186	0.09031	0.11970	0.13281	0.07600	0.33837
	0.24257	0.21790	0.14122	0.17200	0.22006	0.03235	0.06391	0.16538	0.15585	0.09405
	0.12188	0.19414	0.06860	0.16921	0.18932					
J131	0.39523	0.28004	0.29851	0.35477	0.35614	0.26351	0.28634	0.35007	0.22427	0.23766
	0.42603	0.33084	0.27066	0.22843	0.44083	0.19817	0.13875	0.37381	0.38984	0.21911
	0.24744	0.28317	0.32267	0.25929	0.28249	0.18567	0.39992	0.34207	0.38685	0.20916
	1.00000	0.22419	0.30519	0.17637	0.32348	0.24167	0.40561	0.16901	0.24339	0.15636
	0.27082	0.27667	0.22135	0.37320	0.34477	0.19225	0.32473	0.29826	0.29311	0.22007
	0.24071	0.12817	0.06342	0.38645	0.33690					
J132	0.15432	0.15986	0.13316	0.15407	0.13377	0.15887	0.13519	0.20079	0.04003	0.04709
	0.20111	0.16503	0.12520	0.14648	0.20370	0.06611	0.11395	0.17603	0.17723	0.12013
	0.13178	0.16255	0.08987	0.09877	0.08750	0.15703	0.12196	0.18934	0.25385	0.05631
	0.22419	1.00000	0.19126	0.02586	0.13962	0.10351	0.21718	0.12262	0.14845	0.15659
	0.11299	0.16586	0.09358	0.15594	0.20566	0.15917	0.17611	0.06750	0.13792	0.13352
	0.16686	0.11354	0.04264	0.21810	0.15306					
J133	0.29977	0.32263	0.22007	0.43199	0.41424	0.24655	0.34570	0.42225	0.19625	0.28349
	0.47531	0.30844	0.36584	0.28086	0.35140	0.16734	0.25244	0.21984	0.31096	0.15776
	0.24492	0.20483	0.24730	0.24908	0.28976	0.23999	0.30306	0.39398	0.37280	0.29100
	0.30519	0.19126	1.00000	0.16653	0.50279	0.25152	0.33835	0.18754	0.20965	0.45558
	0.23681	0.31902	0.17279	0.27826	0.45700	0.10823	0.21136	0.29921	0.26615	0.19620
	0.22365	0.18748	0.07861	0.36121	0.20363					
J134	0.23934	0.15234	0.18540	0.12502	0.10697	0.05390	0.06630	0.11014	0.06872	0.05018
	0.17264	0.13499	0.12794	0.12639	0.16821	0.08052	0.03099	0.24208	0.14381	0.09463
	0.15584	0.15391	0.10662	0.14339	0.10011	0.12204	0.06765	0.22018	0.18039	0.10049
	0.17637	0.02586	0.16653	1.00000	0.20581	0.11377	0.09519	0.15572	0.09725	0.05475
	0.12820	0.10349	0.12740	0.18434	0.16620	0.14809	0.17437	0.20721	0.13311	0.15843
	0.19422	0.12645	0.05182	0.14986	0.22182					

TABLE 5-6 (Continued)

J135	0.32843	0.29703	0.30940	0.37596	0.40355	0.30965	0.33735	0.41884	0.25135	0.39802
	0.44115	0.19655	0.27203	0.25131	0.33462	0.21932	0.30148	0.31477	0.33959	0.19574
	0.30938	0.22247	0.27183	0.33303	0.33479	0.22956	0.31400	0.29566	0.47290	0.23186
	0.32348	0.13962	0.50279	0.20581	1.00000	0.17838	0.29010	0.25644	0.22116	0.37688
	0.23804	0.33200	0.20709	0.27905	0.48112	0.12541	0.27848	0.27024	0.27508	0.25137
	0.21813	0.24021	0.15914	0.38449	0.36803					
J136	0.18602	0.13125	0.17912	0.23601	0.20881	0.17535	0.22421	0.27501	0.08832	0.16685
	0.24768	0.14877	0.15859	0.11672	0.29106	0.06355	0.07023	0.19965	0.27045	0.10586
	0.16325	0.12006	0.18694	0.13512	0.08492	0.08941	0.18481	0.19762	0.16772	0.09031
	0.24167	0.10351	0.25152	0.11377	0.17838	1.00000	0.09972	0.07236	0.02829	0.10692
	0.17301	0.10385	0.03479	0.17977	0.22558	0.11429	0.12541	0.12272	0.16104	0.13560
	0.17446	0.15578	0.0	0.26516	0.19782					
J137	0.30441	0.22780	0.19937	0.30466	0.32481	0.24218	0.24195	0.24471	0.14591	0.19084
	0.38724	0.20481	0.15876	0.22922	0.29441	0.08741	0.18115	0.13113	0.26995	0.14327
	0.21457	0.16127	0.22461	0.25599	0.18027	0.18499	0.26615	0.24486	0.37928	0.11970
	0.40561	0.21718	0.33835	0.09519	0.29010	0.09972	1.00000	0.22846	0.22926	0.25172
	0.20554	0.33172	0.16924	0.28529	0.39447	0.17574	0.22648	0.22475	0.20772	0.16864
	0.17530	0.15884	0.16520	0.29146	0.32471					
J139	0.16192	0.19857	0.20954	0.19580	0.22164	0.17377	0.18167	0.12418	0.12897	0.28835
	0.15171	0.09837	0.17976	0.17134	0.17413	0.11501	0.15940	0.16916	0.15896	0.09745
	0.20861	0.08797	0.11801	0.18122	0.10161	0.05259	0.09441	0.15540	0.24701	0.13281
	0.16901	0.12262	0.18754	0.15572	0.25644	0.07236	0.22846	1.00000	0.12863	0.22196
	0.11505	0.17487	0.14794	0.16122	0.19638	0.12254	0.12839	0.19612	0.16847	0.20690
	0.14566	0.22065	0.14440	0.19647	0.27873					
J140	0.22883	0.13798	0.16755	0.15284	0.28243	0.14348	0.18195	0.21784	0.13597	0.18384
	0.25987	0.08667	0.15122	0.24155	0.18212	0.09959	0.16099	0.22172	0.15868	0.09856
	0.16478	0.14410	0.18303	0.16942	0.11273	0.14649	0.16295	0.19334	0.25089	0.07600
	0.24339	0.14845	0.20965	0.09725	0.22116	0.02829	0.22926	0.12863	1.00000	0.17290
	0.13226	0.20887	0.63435	0.24907	0.20858	0.12060	0.19040	0.12477	0.21136	0.12041
	0.07825	0.11136	0.07829	0.21644	0.18541					
J141	0.24048	0.15917	0.13751	0.33623	0.32547	0.16832	0.24148	0.33301	0.13506	0.43748
	0.33938	0.12883	0.19860	0.25380	0.16105	0.08683	0.32507	0.07863	0.17015	0.12308
	0.18777	0.17181	0.19223	0.19556	0.19822	0.25681	0.13480	0.27771	0.28912	0.33837
	0.15636	0.15659	0.45558	0.05475	0.37688	0.10692	0.25172	0.22196	0.17290	1.00000
	0.34401	0.31472	0.18929	0.22335	0.34323	0.11664	0.13520	0.16756	0.23385	0.14267
	0.10738	0.33450	0.23139	0.27829	0.16112					
J142	0.20900	0.13424	0.17154	0.29254	0.24058	0.20358	0.16667	0.22206	0.08800	0.25913
	0.22705	0.13857	0.20395	0.17281	0.26324	0.08260	0.19004	0.18901	0.22872	0.08885
	0.18000	0.19407	0.13617	0.06978	0.09911	0.16946	0.12685	0.20064	0.26979	0.24257
	0.27082	0.11299	0.23681	0.12820	0.23804	0.17301	0.20554	0.11505	0.13226	0.34401
	1.00000	0.26053	0.10648	0.22793	0.27777	0.20325	0.19319	0.21504	0.17817	0.15088
	0.15617	0.21365	0.06436	0.24658	0.21961					

TABLE 5-6 (Continued)

J143	0.26363	0.25861	0.22286	0.25167	0.32786	0.23799	0.21866	0.32157	0.09323	0.24541
	0.32337	0.19689	0.19295	0.22546	0.31606	0.15879	0.22771	0.17150	0.21688	0.18218
	0.24304	0.17922	0.18347	0.23359	0.20644	0.20932	0.19284	0.29057	0.30165	0.21790
	0.27667	0.16586	0.31902	0.10349	0.33200	0.10385	0.33172	0.17487	0.20887	0.31472
	0.26053	1.00000	0.25049	0.32613	0.34481	0.17781	0.24625	0.19530	0.25801	0.20318
	0.19823	0.18479	0.15601	0.31193	0.30804					
J144	0.24065	0.14061	0.15881	0.12727	0.22472	0.11370	0.12525	0.23348	0.08599	0.14203
	0.25778	0.10543	0.16608	0.14987	0.18755	0.09599	0.06333	0.14844	0.11599	0.16400
	0.11680	0.11943	0.15809	0.14090	0.15297	0.10244	0.15311	0.22738	0.14219	0.14122
	0.22135	0.09358	0.17279	0.12740	0.20709	0.03479	0.16924	0.14794	0.63435	0.18929
	0.10648	0.25049	1.00000	0.24204	0.18547	0.11842	0.17357	0.17821	0.19224	0.14804
	0.09083	0.14937	0.08145	0.17369	0.13285					
J145	0.33405	0.23948	0.21545	0.23514	0.29897	0.21841	0.14786	0.44349	0.11783	0.21089
	0.40524	0.27379	0.20729	0.23806	0.37591	0.16033	0.16711	0.25302	0.21882	0.25024
	0.20554	0.19665	0.23374	0.21475	0.21972	0.17712	0.22816	0.33406	0.27176	0.17200
	0.37320	0.15594	0.27826	0.18434	0.27905	0.17977	0.28529	0.16122	0.24907	0.22335
	0.22793	0.32613	0.24204	1.00000	0.28123	0.10293	0.28257	0.30198	0.28297	0.28311
	0.25394	0.20950	0.0	0.26637	0.26383					
J146	0.36443	0.26860	0.30422	0.41563	0.43677	0.26008	0.42737	0.39355	0.21396	0.42511
	0.42631	0.25177	0.27686	0.27564	0.34045	0.15846	0.24075	0.30880	0.38464	0.11525
	0.27084	0.22290	0.26506	0.35273	0.30816	0.25528	0.28276	0.33929	0.47198	0.22006
	0.34477	0.20566	0.45700	0.16620	0.48112	0.22558	0.39447	0.19638	0.20858	0.34323
	0.27777	0.34481	0.18547	0.28123	1.00000	0.20066	0.26529	0.29355	0.30091	0.27123
	0.18813	0.27056	0.16733	0.37390	0.30743					
J147	0.19770	0.11470	0.09800	0.18405	0.20639	0.07512	0.22039	0.14182	0.09231	0.03832
	0.16991	0.19275	0.13608	0.22046	0.20229	0.05560	0.10858	0.25069	0.14742	0.13601
	0.07858	0.17198	0.07150	0.17852	0.06034	0.08984	0.13533	0.16378	0.20604	0.03235
	0.19225	0.15917	0.10823	0.14809	0.12541	0.11429	0.17574	0.12254	0.12060	0.11664
	0.20325	0.17781	0.11842	0.10293	0.20066	1.00000	0.12864	0.07918	0.10626	0.13486
	0.19435	0.15060	0.14899	0.32530	0.28648					
J148	0.30278	0.19364	0.21892	0.19656	0.24142	0.14409	0.22579	0.32500	0.18190	0.20739
	0.34050	0.20485	0.20758	0.18024	0.30099	0.18165	0.14551	0.30975	0.23838	0.12167
	0.23123	0.15208	0.21101	0.21528	0.20784	0.17516	0.23871	0.23198	0.27218	0.06391
	0.32473	0.17611	0.21136	0.17437	0.27848	0.12541	0.22648	0.12839	0.19040	0.13520
	0.19319	0.24625	0.17357	0.28257	0.26529	0.12864	1.00000	0.21042	0.20456	0.24055
	0.18185	0.14180	0.13102	0.26804	0.26642					
J149	0.21787	0.20211	0.22128	0.30094	0.24620	0.19499	0.23125	0.27689	0.19272	0.27424
	0.32743	0.15949	0.17889	0.21628	0.21082	0.10337	0.10594	0.19457	0.28662	0.06122
	0.22511	0.21624	0.19376	0.22483	0.19402	0.14479	0.24867	0.26730	0.21873	0.16538
	0.29826	0.06750	0.29921	0.20721	0.27024	0.12272	0.22475	0.19612	0.12477	0.16756
	0.21504	0.19530	0.17821	0.30198	0.29355	0.07918	0.21042	1.00000	0.21089	0.09136
	0.15225	0.21224	0.15445	0.22000	0.25645					

TABLE 5-6 (Continued)

J150	0.27089	0.27458	0.16487	0.22374	0.31215	0.19201	0.23282	0.29693	0.19163	0.22393
	0.28496	0.15550	0.19742	0.17460	0.27751	0.15461	0.18375	0.23405	0.22880	0.13790
	0.20477	0.18696	0.20994	0.22865	0.11619	0.18517	0.20771	0.30003	0.23784	0.15585
	0.29311	0.13792	0.26615	0.13311	0.27508	0.16104	0.20772	0.16847	0.21136	0.23385
	0.17817	0.25801	0.19224	0.28297	0.30091	0.10626	0.20456	0.21089	1.00000	0.21504
	0.16789	0.16944	0.15504	0.27101	0.26161					
J151	0.27333	0.20833	0.21465	0.20047	0.21091	0.14742	0.13768	0.25023	0.13087	0.13608
	0.33624	0.17349	0.24099	0.21402	0.23827	0.09722	0.11590	0.20069	0.24063	0.13285
	0.17525	0.19307	0.22978	0.16921	0.08219	0.15224	0.18030	0.20921	0.25906	0.09405
	0.22007	0.13352	0.19620	0.15843	0.25137	0.13560	0.16864	0.20690	0.12041	0.14267
	0.15088	0.20318	0.14804	0.28311	0.27123	0.13486	0.24055	0.09136	0.21504	1.00000
	0.20766	0.17497	0.13576	0.31482	0.33449					
J152	0.22068	0.17808	0.16324	0.21615	0.15990	0.11725	0.14747	0.15689	0.15005	0.10603
	0.26151	0.24092	0.17705	0.20080	0.18383	0.11712	0.14225	0.17846	0.21557	0.12682
	0.09386	0.11912	0.12436	0.14340	0.09979	0.10736	0.16340	0.19437	0.21095	0.12188
	0.24071	0.16686	0.22365	0.19422	0.21813	0.17446	0.17530	0.14566	0.07825	0.10738
	0.15617	0.19823	0.09083	0.25394	0.18813	0.19435	0.18185	0.15225	0.16789	0.20766
	1.00000	0.23207	0.12654	0.22525	0.24550					
J153	0.15374	0.05059	0.07617	0.19910	0.24051	0.20108	0.17926	0.17722	0.0	0.32331
	0.13547	0.01806	0.14128	0.23034	0.23861	0.11474	0.18862	0.0	0.14871	0.08253
	0.11705	0.18774	0.12239	0.17997	0.07949	0.16118	0.0	0.10892	0.27064	0.19414
	0.12817	0.11354	0.18748	0.12645	0.24021	0.15578	0.15884	0.22065	0.11136	0.33450
	0.21365	0.18479	0.14937	0.20950	0.27056	0.15060	0.14180	0.21224	0.16944	0.17497
	0.23207	1.00000	0.17011	0.31216	0.23174					
J154	0.08216	0.09907	0.13251	0.12740	0.22750	0.08912	0.10483	0.21716	0.0	0.05963
	0.11726	0.03083	0.15630	0.11722	0.11608	0.10984	0.06820	0.04572	0.08792	0.05798
	0.03879	0.08175	0.08128	0.09809	0.03311	0.0	0.07434	0.17452	0.12969	0.06860
	0.06342	0.04264	0.07861	0.05182	0.15914	0.0	0.16520	0.14440	0.07829	0.23139
	0.06436	0.15601	0.08145	0.0	0.16733	0.14899	0.13102	0.15445	0.15504	0.13576
	0.12654	0.17011	1.00000	0.20438	0.16377					
J155	0.44011	0.17276	0.28797	0.31191	0.39625	0.21864	0.27648	0.28132	0.12347	0.31022
	0.31467	0.18573	0.15045	0.30724	0.38895	0.17262	0.19707	0.22707	0.28325	0.14630
	0.17564	0.20634	0.25847	0.31173	0.23501	0.23388	0.25315	0.31683	0.35584	0.16921
	0.38645	0.21810	0.36121	0.14986	0.38449	0.26516	0.29146	0.19647	0.21644	0.27829
	0.24658	0.31193	0.17369	0.26637	0.37390	0.32530	0.26804	0.22000	0.27101	0.31482
	0.22525	0.31216	0.20438	1.00000	0.43811					
J156	0.35716	0.20069	0.26846	0.23505	0.36754	0.20874	0.30746	0.23489	0.26572	0.21264
	0.30765	0.19613	0.23394	0.20630	0.34037	0.13721	0.14728	0.33100	0.29952	0.14222
	0.25124	0.22787	0.21100	0.29452	0.16628	0.12261	0.29270	0.25591	0.40009	0.18932
	0.33690	0.15306	0.20363	0.22182	0.36803	0.19782	0.32471	0.27873	0.18541	0.16112
	0.21961	0.30804	0.13285	0.26383	0.30743	0.28648	0.26642	0.25645	0.26161	0.33449
	0.24550	0.23174	0.16377	0.43811	1.00000					

tetrachoric correlation matrices of the fifty-five items of Test J1 in these two cases, respectively. It should be noted that in both tables there are many small positive correlation coefficients observed for item J154. In applying factor analysis for these tetrachoric correlation matrices, the principal factor solution was adopted, with 55 and 42 common factors in communality estimation, respectively, in these two separate cases. These are the maximum numbers of common factors useable without making any estimated communalities exceed unity. Tables 5-7 and 5-8 present the resulting eigenvalues in the J1/1075 and J1/2259 Cases, respectively. We can see from each result that there is only one dominating common factor, since all the other eigenvalues are negligibly small, i.e., the unidimensionality of the latent space is confirmed in each case. The factor loadings of these common factors are given in Tables 5-9 and 5-10. In these tables, all those values which exceed 0.300 are marked by ⬇ , while those which are negative and whose absolute values exceed the same number are marked by ⇩ , except in the first column where all the values except for those of items J120, J134 and J154 in the J1/1075 Case and of items J116, J120, J134 and J154 in the J1/2259 Case do exceed 0.3000 . Observation of these two tables reveals that there exist a few minor clusters such as those of items J141 and J153, and of items J140 and J144 in both cases, but overall the results support the unidimensionality of the latent space.

The estimates of the item discrimination and item difficulty parameters were obtained by (4.1) and (4.2), and the results are

TABLE 5-7

Eigenvalues of the Tetrachoric Correlation Matrix in the J1/1075 Case Whose Diagonal Elements Were Replaced by the Estimated Communalities Based upon the Fifty-Five Common Factors, Obtained by the Principal Factor Solution in SPSS Version H, release 9.1.

FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
1	14.07600	25.6	25.6
2	2.00527	3.6	29.2
3	1.85225	3.4	32.6
4	1.68286	3.1	35.7
5	1.46180	2.7	38.3
6	1.41706	2.6	40.9
7	1.34809	2.5	43.4
8	1.29391	2.4	45.7
9	1.26612	2.3	48.0
10	1.21675	2.2	50.2
11	1.19252	2.2	52.4
12	1.13169	2.1	54.4
13	1.08745	2.0	56.4
14	1.06089	1.9	58.4
15	1.00829	1.8	60.2
16	0.98982	1.8	62.0
17	0.96252	1.8	63.7
18	0.95201	1.7	65.5
19	0.89599	1.6	67.1
20	0.89268	1.6	68.7
21	0.87130	1.6	70.3
22	0.83960	1.5	71.8
23	0.82416	1.5	73.3
24	0.79013	1.4	74.8
25	0.76911	1.4	76.2
26	0.74202	1.3	77.5
27	0.72782	1.3	78.8
28	0.70499	1.3	80.1
29	0.68304	1.2	81.4
30	0.66735	1.2	82.6
31	0.66201	1.2	83.8
32	0.62523	1.1	84.9
33	0.61147	1.1	86.0
34	0.60033	1.1	87.1
35	0.56625	1.0	88.1
36	0.54957	1.0	89.1
37	0.52276	1.0	90.1
38	0.50601	0.9	91.0
39	0.48853	0.9	91.9
40	0.45904	0.8	92.7
41	0.43907	0.8	93.5
42	0.42453	0.8	94.3
43	0.39065	0.7	95.0
44	0.35969	0.7	95.7
45	0.33716	0.6	96.3
46	0.32326	0.6	96.9
47	0.30133	0.5	97.4
48	0.27201	0.5	97.9
49	0.25921	0.5	98.4
50	0.23477	0.4	98.8
51	0.19081	0.3	99.2
52	0.15292	0.3	99.4
53	0.14473	0.3	99.7
54	0.09919	0.2	99.9
55	0.06580	0.1	100.0

TABLE 5-8

Eigenvalues of the Tetrachoric Correlation Matrix in the J1/2259 Case Whose Diagonal Elements Were Replaced by the Estimated Communalities Based upon the Forty-Two Common Factors, Obtained by the Principal Factor Solution in BMDP4M Revised in 1982.

FACTOR	VARIANCE EXPLAINED	CUMULATIVE PROPORTION OF VARIANCE IN DATA SPACE	CUMULATIVE PROPORTION OF VARIANCE IN FACTOR SPACE
1	12.5805	0.3722	0.3748
2	1.6690	0.4216	0.4245
3	1.3843	0.4625	0.4658
4	1.2342	0.4990	0.5025
5	1.0798	0.5310	0.5347
6	0.8874	0.5572	0.5612
7	0.8429	0.5822	0.5863
8	0.8042	0.6059	0.6102
9	0.7240	0.6274	0.6318
10	0.7035	0.6482	0.6528
11	0.6818	0.6683	0.6731
12	0.6767	0.6884	0.6932
13	0.6238	0.7068	0.7118
14	0.6085	0.7248	0.7299
15	0.5866	0.7422	0.7474
16	0.5413	0.7582	0.7635
17	0.5106	0.7733	0.7788
18	0.4790	0.7875	0.7930
19	0.4694	0.8013	0.8070
20	0.4529	0.8147	0.8205
21	0.4305	0.8275	0.8333
22	0.4174	0.8398	0.8458
23	0.3975	0.8516	0.8576
24	0.3724	0.8626	0.8687
25	0.3646	0.8734	0.8796
26	0.3507	0.8838	0.8900
27	0.3468	0.8940	0.9003
28	0.3305	0.9038	0.9102
29	0.3176	0.9132	0.9197
30	0.3063	0.9223	0.9288
31	0.2882	0.9308	0.9374
32	0.2757	0.9389	0.9456
33	0.2565	0.9465	0.9532
34	0.2354	0.9535	0.9602
35	0.2182	0.9599	0.9667
36	0.2139	0.9663	0.9731
37	0.1903	0.9719	0.9788
38	0.1717	0.9770	0.9839
39	0.1688	0.9820	0.9889
40	0.1459	0.9863	0.9933
41	0.1206	0.9899	0.9969
42	0.1055	0.9930	1.0000
43	0.0663	0.9949	
44	0.0533	0.9965	
45	0.0450	0.9979	
46	0.0350	0.9989	
47	0.0237	0.9996	
48	0.0091	0.9999	
49	0.0046	1.0000	
50	-0.0055		
51	-0.0277		
52	-0.0399		
53	-0.0508		
54	-0.0791		
55	-0.0883		

TABLE 5-9

Fa^tor Loading Matrix for the Fifty-Five Items of Test J1 ir the J1/1075 Case.

ITEM	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
J101	0.61043	0.19598	-0.05464	0.07542	0.07286	-0.18941	-0.14135
J102	0.47598	-0.10294	-0.12100	-0.08564	-0.00427	-0.03974	0.10686
J103	0.54035	0.04782	-0.25590	0.02518	0.29484	0.02543	-0.25564
J104	0.57770	-0.11864	0.00231	0.12198	0.07184	-0.03308	0.00607
J105	0.61634	-0.12708	0.11562	-0.04205	-0.03089	0.02378	0.14063
J106	0.44726	-0.15486	-0.07819	0.05233	0.17241	0.00990	0.30015
J107	0.49329	-0.12425	-0.09758	0.01361	0.09995	0.12483	-0.08452
J108	0.63700	-0.34440	-0.16968	-0.09753	-0.45234	0.05166	-0.05187
J109	0.31339	0.07604	-0.12758	-0.11168	0.37257	-0.10823	0.18090
J110	0.53911	-0.19497	0.22553	-0.17537	0.28185	0.04353	-0.06265
J111	0.70100	-0.09472	-0.05455	-0.07089	-0.06857	-0.25146	-0.08487
J112	0.43670	-0.01963	-0.24108	0.17325	-0.06594	-0.16625	0.06981
J113	0.48428	-0.08023	-0.07331	0.08558	-0.03805	0.02050	0.19791
J114	0.53419	0.14031	0.12352	0.08886	-0.08975	-0.21592	0.00148
J115	0.63185	0.07652	-0.12490	-0.01808	-0.02749	0.05582	0.05837
J116	0.35899	-0.08805	-0.10085	-0.05841	-0.08215	0.22747	0.07647
J117	0.33359	-0.15038	0.13042	0.08361	0.14209	0.13210	0.10490
J118	0.48805	0.19061	-0.15250	-0.01070	0.27958	0.15336	-0.07751
J119	0.52329	-0.06907	-0.21062	0.06751	0.06373	0.07083	0.29423
J120	0.28878	0.13649	0.06027	0.[illegible]3521	-0.06289	-0.11481	0.10335
J121	0.44657	-0.03185	-0.0[illegible]31	-0.08235	0.01485	0.02948	0.06723
J122	0.47122	0.01455	-0.01102	-0.00421	0.05932	-0.12274	-0.07499
J123	0.46670	0.04409	-0.07771	-0.06309	0.06072	-0.05100	-0.17089
J124	0.49890	-0.05324	-0.23578	-0.01375	-0.04186	0.15332	-0.02585
J125	0.46241	-0.19754	-0.26570	-0.05983	0.16120	0.05038	-0.03056
J126	0.42898	-0.03245	0.07570	0.02962	0.07486	-0.15596	-0.09084
J127	0.47687	-0.09154	-0.32314	0.00752	-0.04546	0.03237	-0.14351
J128	0.61289	-0.05743	-0.05558	0.00133	-0.04110	-0.06901	-0.23566
J129	0.62127	-0.03373	0.20749	-0.01614	0.01439	0.30965	0.03696
J130	0.33121	-0.24558	0.27901	0.07706	0.1[illegible]497	-0.22906	0.03468
J131	0.65912	0.08031	-0.16017	-0.06083	-0.0[illegible]098	0.00190	0.13589
J132	0.39622	0.1[illegible]709	0.02072	0.09270	-0.1[illegible]175	-0.03400	0.07169
J133	0.59063	-0.39896	0.15478	-0.01710	-0.2[illegible]000	-0.09010	-0.08355
J134	0.29280	0.1[illegible]472	0.10620	0.07367	0.0[illegible]350	-0.02260	-0.17259
J135	0.64151	-0.15051	0.12960	-0.02264	0.0[illegible]544	0.19200	-0.07295
J136	0.34499	-0.04909	-0.12861	0.19779	-0.0[illegible]179	-0.0940[illegible]	0.06426
J137	0.56344	0.07955	0.01312	-0.05585	-0.0[illegible]771	0.1190[illegible]	[illegible].04678
J139	0.38553	0.13285	0.13835	-0.00844	0.0[illegible]118	0.24991	[illegible].09375
J140	0.38741	0.30171	0.12788	-0.62076	-0.0[illegible]057	-0.0031[illegible]	[illegible].04837
J141	0.49966	-0.33105	0.43054	0.03567	0.0[illegible]502	-0.0627[illegible]	-0.09764
J142	0.44664	0.04192	0.18276	0.12073	0.1[illegible]081	-0.1572[illegible]	0.2[illegible]457
J143	0.[illegible]	0.02038	0.09103	-0.04597	-0.0[illegible]398	0.0034[illegible]	[illegible].01080
J144	0.36260	0.28799	0.12820	-0.54492	-0.0[illegible]326	-0.0770[illegible]	[illegible].00933
J145	0.61314	0.03202	-0.06676	-0.13497	-0.2[illegible]942	-0.1046[illegible]	[illegible].17558
J146	0.65428	-0.15909	0.05045	0.07158	0.1[illegible]651	0.0499[illegible]	-[illegible].12365
J147	0.40778	0.3[illegible]189	0.07136	0.25840	-0.0[illegible]069	0.0756[illegible]	[illegible].07242
J148	0.45427	0.2[illegible]737	-0.11561	-0.03423	-0.0[illegible]966	0.0649[illegible]	-[illegible].13935
J149	0.45706	0.0[illegible]330	-0.00825	-0.17993	-0.0[illegible]596	-0.0908[illegible]	-[illegible].02823
J150	0.45803	0.0[illegible]970	-0.03507	-0.09321	-0.0[illegible]019	-0.0415[illegible]	[illegible].00427
J151	0.43711	0.2[illegible]778	-0.03726	0.20683	-0.1[illegible]853	-0.228[illegible]	0.01314
J152	0.32579	0.26849	-0.02789	0.20620	-0.1[illegible]235	0.0783[illegible]	0.06023
J153	0.41996	0.07903	0.41016	0.09334	-0.0[illegible]081	0.0738[illegible]	0.08552
J154	0.21850	0.10422	0.11416	0.18322	-0.2[illegible]558	0.3204[illegible]	-0.16296
J155	0.65222	0.22260	0.13611	0.16775	0.0[illegible]086	-0.0[illegible]22	-0.20694
J156	0.57965	0.32560	0.11026	0.13656	0.0[illegible]438	0.0979[illegible]	0.02313

TABLE 5-9 (Continued)

ITEM	FACTOR 8	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
J101	0.00763	-0.00051	-0.03522	-0.08039	0.01240	-0.00642	0.04204
J102	-0.15886	0.25598	0.17169	-0.03037	-0.04909	-0.13255	0.04312
J103	-0.03843	0.08286	0.02414	-0.11331	-0.05337	-0.01341	0.05923
J104	0.04746	-0.04592	0.05422	-0.04929	0.29107	-0.09222	0.11532
J105	-0.03021	0.01756	0.04449	0.02040	0.13036	0.07887	-0.07228
J106	0.06482	0.13181	0.01592	-0.20103	-0.06081	0.04698	0.06786
J107	0.00889	-0.05946	-0.02294	0.20386	0.07183	0.03308	0.12526
J108	0.00554	0.05483	0.07655	0.08379	-0.15657	0.08641	0.04770
J109	0.08677	0.20700	0.09128	0.12404	0.18789	0.04689	-0.09323
J110	0.06638	-0.04436	-0.05647	-0.06437	-0.12554	-0.04045	0.12596
J111	-0.10491	0.09073	-0.06255	0.11389	0.00773	0.07512	-0.16961
J112	-0.16206	-0.03849	0.10444	-0.09824	-0.05507	-0.11130	-0.04372
J113	-0.25317	0.03674	-0.04896	0.03438	0.06900	0.12557	0.23286
J114	-0.06060	0.03956	0.12123	-0.01037	0.07639	-0.00804	0.03485
J115	0.13234	-0.22059	0.03884	0.07629	-0.05233	-0.08098	-0.01629
J116	0.12379	0.16273	0.02715	-0.02105	0.05664	0.00486	-0.06743
J117	-0.14093	0.08106	-0.07484	-0.07269	-0.06092	0.17381	-0.20435
J118	-0.25509	-0.01375	0.02197	0.25815	-0.02638	-0.04137	0.01745
J119	0.04280	-0.10076	-0.13409	-0.00872	0.14772	0.02277	0.03526
J120	0.10949	-0.14115	0.08654	0.05337	0.08353	0.20858	0.00575
J121	0.02439	0.01699	-0.08103	0.01370	0.03364	-0.01897	-0.05137
J122	-0.04886	0.00382	0.07016	0.25823	-0.25539	0.20300	0.12116
J123	0.07169	-0.04059	-0.24170	-0.13459	-0.04397	0.14286	0.25507
J124	0.16440	-0.02170	-0.05092	0.12486	0.15739	0.00774	-0.24109
J125	0.06581	-0.07428	0.26553	-0.07083	-0.10840	-0.03932	0.02255
J126	0.05148	-0.06655	0.14437	-0.13544	0.09231	0.02915	-0.11531
J127	0.01793	0.08644	-0.21217	-0.00592	0.02428	0.14433	-0.07062
J128	-0.01154	0.02382	0.17210	0.00135	0.10136	0.00574	-0.05203
J129	-0.14557	-0.17134	-0.10908	0.06521	-0.14151	-0.10648	-0.05821
J130	0.12589	0.14817	-0.03379	0.02768	-0.07672	0.00240	-0.12932
J131	0.15480	-0.19684	-0.02219	-0.11887	-0.11863	0.05139	0.00596
J132	-0.18168	-0.11359	0.01246	-0.08165	-0.10105	-0.07639	0.01383
J133	-0.23030	-0.15042	-0.06192	0.03626	0.15696	-0.21655	0.00972
J134	0.10290	0.11907	0.02762	0.10482	-0.06879	-0.22826	0.00023
J135	-0.02801	0.06623	-0.11528	0.05560	0.00871	0.00002	-0.13188
J136	0.05517	-0.17266	-0.15034	0.16634	0.09668	-0.00722	0.07486
J137	0.03466	-0.08286	0.04912	-0.37338	-0.01676	0.00039	-0.02903
J139	-0.02054	0.15854	-0.04602	-0.12255	0.10473	-0.17746	0.15098
J140	-0.21390	-0.06442	0.00918	0.00270	0.05406	0.12442	-0.08026
J141	-0.01994	0.07582	0.08357	-0.06801	-0.00579	0.09418	0.01231
J142	0.04651	-0.09349	0.05061	0.04292	-0.13590	0.08597	0.05201
J143	-0.03036	0.05158	0.06652	-0.11766	-0.13964	-0.03690	-0.04010
J144	-0.02819	-0.02170	0.01927	-0.01353	0.16830	0.01198	0.08245
J145	0.19290	0.04428	-0.00444	0.04053	-0.15185	-0.08222	-0.06027
J146	-0.06678	-0.10346	-0.01917	-0.01683	0.06681	-0.09673	0.02931
J147	-0.13325	-0.11780	0.35280	0.11681	0.04397	0.03586	-0.01138
J148	0.06002	-0.00689	-0.00757	-0.07652	-0.09852	-0.00025	-0.00867
J149	0.28899	0.16644	0.04992	0.12518	0.02985	-0.17810	0.11637
J150	0.02931	0.05994	-0.05824	0.06600	-0.06063	0.02506	0.08360
J151	-0.18556	0.23518	-0.34330	-0.10102	0.03946	-0.00230	-0.00504
J152	-0.00127	0.21780	0.03088	0.02226	-0.03241	-0.13385	-0.00239
J153	0.22570	0.02197	-0.10606	0.18331	0.00466	-0.00660	0.12340
J154	0.03886	0.24208	0.17636	-0.04213	0.09775	0.28220	0.10525
J155	0.16845	-0.19582	-0.04034	-0.14097	0.09644	0.06087	-0.10289
J156	0.00245	0.02689	-0.11936	0.07491	-0.14164	-0.04541	-0.17847

TABLE 5-9 (Continued)

ITEM	FACTOR 15	FACTOR 16	FACTOR 17	FACTOR 18	FACTOR 19	FACTOR 20	FACTOR 21
J101	-0.05062	-0.00199	-0.03897	0.11128	-0.04133	-0.15403	-0.07230
J102	-0.04130	0.19733	-0.03480	-0.01181	-0.02851	-0.01680	-0.05333
J103	0.09212	0.18128	0.00089	0.03122	-0.05555	0.05087	0.11975
J104	-0.03338	-0.04123	0.00203	-0.05638	-0.03357	-0.17535	0.13379
J105	-0.14037	-0.07260	-0.13220	-0.01985	0.05232	-0.15706	-0.00195
J106	0.09626	-0.03889	-0.07096	-0.18814	-0.07029	-0.04105	-0.01104
J107	0.04874	0.12994	-0.12659	0.04178	-0.03517	-0.02776	-0.16051
J108	0.07475	-0.02123	-0.03388	0.00046	-0.06175	-0.10978	-0.00834
J109	-0.06954	-0.11282	0.05947	0.13835	0.00668	-0.07174	0.10184
J110	-0.05644	-0.01973	0.01546	0.03448	-0.17792	0.04698	-0.08360
J111	-0.13643	-0.05985	0.03280	-0.22197	-0.06769	0.10922	-0.03707
J112	-0.07060	0.00826	0.15287	0.15405	-0.10458	-0.05189	0.00955
J113	0.02623	-0.01397	-0.08573	0.16900	0.13575	0.09279	-0.05526
J114	0.09963	0.06482	0.17363	0.08671	-0.01497	-0.05057	-0.03283
J115	-0.01829	-0.05299	-0.14863	0.05522	-0.06145	0.04333	0.09697
J116	0.17974	0.02141	-0.03847	-0.14002	0.16599	-0.01286	0.04476
J117	0.08684	0.07699	-0.01552	0.07423	-0.09521	0.08256	0.10204
J118	-0.06923	-0.06666	0.07131	-0.03824	0.05431	0.06267	-0.01881
J119	0.00336	-0.06781	0.09422	-0.14178	-0.05240	0.13538	-0.11237
J120	0.02524	0.04044	0.13721	0.09438	-0.02245	0.25674	0.08544
J121	-0.13012	0.12784	0.00822	0.00235	0.11239	-0.03670	-0.02888
J122	-0.04514	-0.04770	0.09318	-0.16734	0.04943	-0.06330	-0.00108
J123	-0.00037	-0.00868	0.12385	-0.03694	0.13202	0.01290	0.14198
J124	-0.05216	0.05903	0.08787	0.02692	-0.03095	-0.02848	-0.07838
J125	0.23929	-0.24558	0.08867	0.02652	0.11842	0.01677	-0.08608
J126	-0.04459	-0.16033	-0.23322	-0.07250	0.06083	0.16590	-0.00261
J127	0.06165	0.09279	-0.08667	0.05662	-0.02881	0.04726	-0.11826
J128	-0.08070	0.02553	-0.12028	0.02936	-0.01885	0.00299	0.08564
J129	0.02442	0.01840	0.08458	0.01980	-0.03647	-0.11159	0.06874
J130	0.12194	0.11812	0.04375	0.08529	0.08154	-0.00997	-0.12145
J131	-0.11469	0.07279	0.09602	0.04084	0.11319	-0.05137	-0.05448
J132	-0.00066	-0.10102	0.01005	-0.07709	0.00556	0.04812	-0.00063
J133	0.08184	0.00375	0.00334	0.04542	0.16224	0.08663	0.00975
J134	-0.03343	0.04124	-0.03817	-0.16583	0.03641	0.08373	0.03709
J135	0.09273	-0.09860	0.11333	-0.02856	-0.01604	0.03340	0.15555
J136	-0.01615	0.19967	-0.06026	-0.05054	-0.04862	0.04820	0.15351
J137	-0.21065	0.13193	0.08480	-0.13860	-0.06254	0.02249	-0.05117
J139	-0.07393	0.00589	-0.01702	0.06971	0.12448	0.05832	-0.00677
J140	0.08436	0.12097	-0.03622	-0.03775	-0.02965	-0.06160	0.01891
J141	-0.09080	0.02847	0.10199	0.03788	0.02206	0.05770	-0.03335
J142	0.06016	0.16511	-0.19030	-0.03282	0.05640	-0.03019	0.05056
J143	-0.00453	-0.00822	-0.09797	0.02633	0.03900	0.05304	0.12199
J144	0.15265	-0.04143	0.02538	0.01929	-0.07526	0.07319	-0.04784
J145	-0.03540	-0.11393	0.04105	0.14884	-0.03698	0.02298	0.09747
J146	-0.04995	-0.09008	0.01419	-0.00857	-0.15864	-0.02504	-0.04961
J147	0.05158	0.04984	0.01126	-0.11080	0.00411	-0.03457	-0.06979
J148	-0.05122	-0.07585	-0.17177	0.13695	-0.02493	0.11037	-0.10698
J149	-0.03081	0.10462	0.10277	-0.07149	0.08409	0.06196	-0.02294
J150	-0.03142	-0.11115	-0.09363	0.03685	-0.01672	-0.09503	0.12667
J151	0.06003	-0.15763	-0.01095	-0.07677	-0.00225	-0.07024	-0.04579
J152	0.20528	0.05950	0.00459	0.00625	-0.17568	0.07703	0.02788
J153	0.01334	-0.11038	-0.04599	0.02525	-0.16714	-0.01085	-0.09557
J154	-0.12390	-0.04717	0.05091	0.03739	-0.00548	0.00475	0.02204
J155	0.24915	0.01805	0.01818	-0.03320	0.06334	-0.13960	-0.04122
J156	-0.10249	-0.01657	-0.01129	0.07986	0.20171	-0.00543	-0.05941

TABLE 5-9 (Continued)

ITEM	FACTOR 22	FACTOR 23	FACTOR 24	FACTOR 25	FACTOR 26	FACTOR 27	FACTOR 28
J101	-0.01051	0.13638	0.06865	-0.02555	0.03706	-0.15833	-0.13576
J102	-0.10832	-0.09979	0.09154	-0.08661	0.11990	-0.10792	-0.06194
J103	0.03894	0.00349	0.01832	-0.03525	0.00479	0.07004	0.03360
J104	-0.13667	-0.02174	-0.09058	0.02778	-0.01904	-0.05733	0.09109
J105	0.04154	-0.09691	-0.08012	0.00673	0.13662	0.07309	0.05648
J106	0.12566	-0.00054	-0.01153	0.05996	-0.10227	-0.08919	-0.09816
J107	-0.14363	-0.09493	-0.01074	0.01064	-0.07225	-0.00859	0.00935
J108	-0.01158	-0.05849	0.12613	0.05553	0.06422	0.03630	0.00411
J109	0.01313	0.02589	0.04315	0.02256	0.01176	0.02618	0.06765
J110	0.02766	-0.06745	0.00399	-0.07815	-0.05328	0.00849	0.06236
J111	0.02217	-0.02197	-0.04344	-0.09975	-0.01419	0.03435	-0.01988
J112	0.23039	-0.01275	0.03401	0.08553	-0.07301	0.03676	0.04444
J113	0.01333	0.10903	-0.01853	0.02566	-0.05779	-0.02626	-0.01626
J114	-0.06683	-0.12053	-0.03099	0.08491	0.04048	0.03467	-0.02506
J115	0.07334	-0.01885	0.09031	-0.14512	0.09230	-0.00209	-0.02164
J116	0.08680	0.04077	-0.02773	-0.11105	-0.03640	0.04781	-0.01309
J117	0.01500	-0.09295	-0.05874	0.03084	0.00127	-0.06690	0.00054
J118	0.04463	-0.07044	-0.11299	0.02577	-0.00270	-0.00679	-0.13735
J119	-0.04739	0.04505	0.06891	0.03166	0.00527	0.01479	-0.03235
J120	-0.11067	-0.01120	0.01096	-0.12523	0.07759	0.00113	-0.05842
J121	-0.01629	0.09678	0.02093	0.10019	0.12788	-0.01392	-0.10222
J122	0.05493	-0.02275	-0.04130	-0.04128	0.02771	-0.06855	0.13665
J123	-0.05766	-0.05217	0.02443	0.07085	0.03797	-0.06209	0.04690
J124	-0.01163	0.04290	0.11130	-0.00812	-0.05444	-0.11633	0.09818
J125	-0.02846	0.01437	-0.06876	0.00155	0.06308	0.08749	-0.04722
J126	-0.04099	-0.02683	0.00623	0.17986	0.00074	-0.05391	0.03693
J127	-0.02223	0.06277	-0.11607	0.01581	-0.01516	-0.03723	0.04521
J128	0.02121	0.12316	-0.20181	-0.09431	-0.00087	0.02940	-0.02533
J129	-0.11456	0.15088	-0.11523	0.09026	0.02154	0.03743	-0.04782
J130	0.07788	0.05507	-0.03215	0.03609	0.12788	0.03859	-0.01058
J131	0.03322	0.02983	-0.06818	-0.09669	0.04899	0.00468	0.06810
J132	0.07270	0.10188	-0.00432	0.07289	0.08460	-0.10283	0.10911
J133	0.05171	-0.00646	0.00479	-0.08481	-0.08257	-0.05082	0.03229
J134	0.01281	0.08262	0.05769	0.04702	0.04036	0.01161	-0.06436
J135	-0.06108	-0.02052	0.18606	0.05265	0.06143	-0.01313	0.00385
J136	0.18575	-0.08353	-0.01956	0.11423	0.03221	0.06933	-0.06477
J137	-0.05000	0.00147	-0.04672	-0.02236	-0.02303	0.04391	-0.02132
J139	0.09012	-0.14164	0.02192	-0.09285	0.06251	0.04035	0.04870
J140	0.03561	-0.05589	-0.00829	0.05654	-0.05428	0.05801	-0.00143
J141	0.03495	0.02721	0.07859	-0.02174	-0.11491	0.00773	-0.03015
J142	-0.10193	0.14509	0.10046	-0.00865	-0.05412	0.14777	0.06679
J143	-0.09093	-0.03561	-0.05130	0.00893	0.00847	-0.12425	0.01760
J144	0.07926	0.14303	0.03803	-0.00281	0.04455	-0.03356	0.02179
J145	-0.12794	-0.06295	-0.10841	0.00983	-0.15107	0.01884	-0.09089
J146	-0.03521	0.09751	0.07949	-0.00901	0.00794	0.14645	0.01466
J147	-0.04800	-0.05604	0.08551	-0.00761	-0.07261	-0.02572	0.00759
J148	-0.00024	-0.11075	0.06406	0.12654	0.02167	0.07904	0.02914
J149	-0.01438	-0.00217	-0.03369	0.12769	-0.09856	0.02456	0.03106
J150	0.05664	0.04410	0.11569	-0.07786	-0.10720	-0.02955	-0.07884
J151	-0.10969	-0.03962	0.01355	-0.08057	0.00473	0.13234	-0.00724
J152	-0.00638	0.08878	-0.08873	-0.01497	0.00832	-0.02570	0.13529
J153	0.08491	-0.04128	-0.11269	-0.00952	0.06168	-0.06595	-0.01928
J154	0.07023	0.09519	0.01443	0.04500	-0.01210	0.05018	-0.03712
J155	0.08746	-0.11461	0.00721	-0.03737	-0.03963	-0.03471	-0.06801
J156	0.02028	-0.00748	0.04518	-0.01220	-0.10221	-0.01166	0.05329

TABLE 5-9 (Continued)

ITEM	FACTOR 29	FACTOR 30	FACTOR 31	FACTOR 32	FACTOR 33	FACTOR 34	FACTOR 35
J101	0.00461	0.06086	-0.06572	-0.01929	-0.03663	-0.03935	-0.02763
J102	0.06101	-0.01381	0.01346	0.04512	-0.00286	0.03731	0.02358
J103	-0.02162	0.01588	-0.05148	0.09074	-0.01254	0.00244	-0.01502
J104	0.10508	-0.05639	-0.02724	0.02173	0.01886	0.10068	-0.02201
J105	-0.10245	-0.03358	0.01751	0.05835	-0.05113	-0.02419	-0.01858
J106	-0.08512	-0.03019	-0.07976	0.01689	-0.00324	-0.03228	-0.03429
J107	-0.11491	0.07982	-0.00961	0.03667	0.09194	-0.00303	-0.04786
J108	0.01454	-0.01378	-0.05306	-0.00043	0.04011	0.00331	0.01647
J109	-0.00435	0.13227	0.00491	-0.00855	0.03521	-0.00775	-0.00609
J110	0.00503	-0.00365	-0.04984	-0.02666	-0.08517	0.02102	0.04587
J111	0.00589	0.05212	-0.03010	-0.10435	-0.02282	-0.00314	-0.05238
J112	-0.00065	-0.05064	0.05710	0.02859	-0.03253	-0.00309	-0.05955
J113	-0.00676	-0.07473	-0.03430	-0.05190	-0.02437	0.01946	0.00414
J114	-0.01105	0.09848	-0.03668	-0.05319	-0.05829	-0.06076	0.04062
J115	0.05877	-0.00846	-0.09386	-0.03223	0.00244	-0.00264	-0.03017
J116	-0.01961	0.14298	0.02248	0.01035	-0.05280	0.05404	0.00971
J117	0.06013	-0.04865	0.07224	0.06570	0.02986	-0.01677	0.02016
J118	0.02172	-0.05288	0.06193	-0.05440	-0.01151	0.05113	0.01040
J119	0.02086	0.03051	0.01471	0.08471	-0.05378	-0.03363	0.00610
J120	-0.05933	-0.02822	-0.01813	0.07583	0.00935	-0.01809	0.00381
J121	0.02242	-0.00834	0.01422	-0.03374	-0.02615	0.02609	0.07216
J122	0.02841	-0.05300	-0.03571	0.04331	-0.00406	-0.01495	0.01853
J123	-0.08283	0.02884	0.04883	0.00295	0.00306	-0.00010	-0.01044
J124	0.04423	-0.07269	0.05737	0.00341	0.03013	-0.04410	0.00457
J125	0.08816	-0.00255	0.02396	-0.02773	0.08790	-0.03308	-0.00097
J126	0.00553	-0.02195	-0.06057	-0.00176	-0.02731	0.02646	0.05002
J127	0.06291	-0.01585	0.00755	-0.03104	-0.01960	-0.01691	0.00947
J128	-0.00800	-0.01725	-0.00041	0.04304	-0.00027	-0.07372	0.03053
J129	0.04596	0.04380	-0.04544	0.04093	-0.03237	-0.02835	-0.03644
J130	-0.11572	-0.05758	0.01108	0.00988	0.04222	0.05322	-0.01787
J131	-0.01416	0.01515	0.04825	-0.01506	-0.05945	0.07378	-0.00722
J132	0.01159	0.10496	0.00154	0.07007	0.07079	-0.02244	0.05172
J133	-0.04416	0.04109	0.02650	0.04338	-0.04081	-0.01013	-0.01847
J134	-0.00838	-0.04216	0.04254	0.11739	-0.00471	0.01329	-0.03843
J135	-0.03055	-0.03138	-0.03250	-0.07681	-0.05806	-0.00145	-0.02723
J136	0.04224	0.04869	-0.02769	-0.06331	0.09049	0.02638	0.01605
J137	-0.02759	0.01475	0.02370	-0.04230	0.09492	-0.00032	0.00115
J139	0.04978	-0.05880	-0.03804	-0.03107	0.02684	-0.08328	0.01083
J140	0.00336	0.00613	-0.02468	0.03814	-0.00100	-0.01872	0.01741
J141	0.15411	0.08987	0.00343	0.01420	0.05353	0.04181	0.00347
J142	0.10185	-0.03506	0.06099	-0.04789	-0.03250	-0.04049	-0.02284
J143	-0.06230	0.00911	0.11016	-0.12579	0.04234	-0.03311	-0.06891
J144	0.00871	-0.06270	0.00211	-0.00357	0.06166	0.05557	-0.04795
J145	-0.03124	-0.04256	-0.04491	0.05180	-0.00431	0.04780	0.01581
J146	-0.15596	-0.05650	0.03199	-0.03940	0.04048	0.00625	0.06126
J147	-0.05462	0.00090	0.04398	-0.01643	-0.02097	0.02211	-0.00464
J148	0.04314	0.07890	0.07807	0.04447	-0.06313	0.03702	-0.03347
J149	0.02624	-0.05472	0.00956	-0.01673	-0.02138	-0.07300	0.00655
J150	-0.05010	0.01542	0.14525	0.01549	0.02183	-0.00946	0.08977
J151	0.06669	-0.03258	0.01920	0.03695	0.04181	0.00572	-0.01139
J152	-0.04483	0.02723	-0.01810	-0.07676	-0.02399	0.04356	0.05115
J153	0.04606	0.04618	0.07894	0.01555	0.01015	-0.01645	-0.01739
J154	-0.00280	-0.01587	-0.02509	0.00512	-0.01380	0.01462	-0.02879
J155	0.03604	-0.06401	0.01391	-0.01167	-0.02195	0.00057	0.02771
J156	-0.04575	0.00534	-0.14002	0.01836	0.08296	0.01456	0.01260

TABLE 5-9 (Continued)

ITEM	FACTOR 36	FACTOR 37	FACTOR 38	FACTOR 39	FACTOR 40	FACTOR 41	FACTOR 42
J101	0.05383	-0.00447	0.00980	0.01487	0.00900	-0.00646	0.03567
J102	-0.02005	0.02179	0.00368	0.00610	-0.00606	-0.00391	-0.07787
J103	0.03437	-0.02104	-0.00415	-0.00999	-0.04800	-0.03668	0.02030
J104	-0.02015	-0.00887	0.00556	-0.00791	-0.01130	0.00438	-0.03008
J105	0.05027	-0.00726	-0.00351	-0.00125	-0.02193	-0.07189	0.01375
J106	-0.01704	0.01468	0.00769	-0.01533	0.00097	0.01841	-0.01339
J107	-0.00368	0.01785	-0.01333	-0.01218	0.00525	0.01583	0.03258
J108	0.01511	0.00717	-0.00121	0.00789	0.01085	-0.01292	0.05650
J109	-0.01854	0.02139	0.00510	0.01405	0.03537	0.03075	0.03192
J110	-0.01156	0.00497	-0.00386	0.00387	-0.00358	0.02987	0.00476
J111	0.04390	0.01384	0.00198	-0.00182	-0.05139	0.02929	-0.00724
J112	-0.01571	-0.01765	-0.00755	-0.01177	0.00590	0.01350	0.02132
J113	0.03470	-0.02642	-0.00208	0.00770	0.01340	0.02070	-0.06764
J114	-0.00079	-0.02737	-0.00052	-0.00559	0.01822	-0.03621	-0.05572
J115	-0.06229	-0.02740	-0.00209	0.01618	-0.01698	-0.02595	0.00164
J116	0.00157	-0.04294	0.01145	-0.00479	0.00882	-0.00082	-0.01892
J117	-0.00563	-0.00781	0.01139	0.02911	-0.00744	0.00727	0.05312
J118	0.00842	0.01214	0.00181	-0.00115	-0.00765	-0.05702	0.00101
J119	-0.04101	0.00614	-0.02323	0.01522	0.00434	-0.03258	-0.00731
J120	0.00853	0.00656	0.01172	-0.01962	0.00506	0.00377	0.00012
J121	-0.04608	-0.02957	-0.01198	-0.01787	-0.03842	0.07374	0.09011
J122	-0.01684	-0.01524	0.00417	-0.00201	0.04088	0.03733	-0.01056
J123	0.01762	-0.01277	-0.00258	0.01582	-0.03192	0.02301	0.00410
J124	0.07575	-0.01404	-0.00319	-0.00410	-0.02170	0.02360	-0.06820
J125	0.03222	-0.00524	-0.00388	0.00510	-0.01174	0.02536	-0.00589
J126	0.04660	0.00605	-0.00141	0.00188	0.01638	-0.00841	0.02731
J127	-0.03724	-0.00802	0.01504	-0.01574	0.04585	-0.05510	0.04665
J128	-0.05759	0.01205	-0.01167	-0.00304	0.01310	0.04717	-0.03038
J129	0.02479	0.02644	0.01001	-0.00157	-0.00426	0.01207	-0.00830
J130	-0.01193	0.01274	0.00237	0.00336	-0.01534	0.01075	-0.03285
J131	0.01360	0.04054	-0.00441	0.00247	0.03891	-0.02196	0.02155
J132	-0.01768	0.01873	0.00422	-0.01665	-0.03221	-0.02576	-0.01941
J133	-0.01112	0.01156	0.00705	0.01516	-0.00175	0.02658	0.02864
J134	0.04452	-0.01570	-0.00831	0.00716	0.07041	0.00717	0.00217
J135	-0.02441	0.00944	-0.00114	-0.01965	0.03373	0.00755	-0.01961
J136	0.02028	0.01569	0.00244	0.00412	0.02048	0.01279	-0.02587
J137	0.01712	-0.01840	0.00945	0.00899	0.02451	0.01510	-0.01212
J139	0.04863	0.01734	0.00346	-0.01567	0.01803	0.02619	0.05179
J140	0.00593	-0.01013	-0.01029	0.00562	0.01657	0.01832	-0.03391
J141	0.01186	-0.00725	-0.01172	-0.01053	0.01183	-0.05103	0.02378
J142	0.01848	0.00878	0.00124	-0.00326	-0.01794	-0.00566	-0.00610
J143	-0.04686	-0.01201	-0.01576	-0.00282	0.01320	-0.02820	-0.00981
J144	-0.00988	0.00470	0.00546	-0.00686	-0.00758	-0.01952	0.03026
J145	0.02920	-0.00801	-0.00224	-0.00503	-0.00574	0.00977	0.02139
J146	-0.02261	-0.01963	0.01363	0.00702	0.01619	-0.01753	-0.02323
J147	-0.01535	-0.01184	0.01030	0.00170	-0.01187	0.02886	0.08808
J148	-0.02239	0.01025	0.01470	-0.00592	-0.00914	0.05138	-0.06199
J149	-0.04916	0.01278	0.01470	0.01291	-0.03189	-0.04281	0.01860
J150	0.01847	0.02190	0.00212	-0.01103	-0.01011	-0.02115	-0.01432
J151	-0.02609	-0.00013	-0.00253	0.00128	0.00358	0.01467	0.02631
J152	0.04472	0.01674	-0.01504	0.01010	-0.00543	0.00774	0.02184
J153	0.00842	-0.03518	-0.00012	-0.00200	-0.00948	0.01099	-0.00892
J154	-0.02704	0.02648	-0.00498	0.01243	-0.02276	0.00029	-0.01892
J155	-0.01695	0.02969	-0.00762	0.00192	-0.00099	0.00354	-0.01813
J156	-0.03715	-0.01099	-0.00170	0.00494	-0.01509	-0.02264	-0.03299

TABLE 5-9 (Continued)

ITEM	FACTOR 43	FACTOR 44	FACTOR 45	FACTOR 46	FACTOR 47	FACTOR 48	FACTOR 49
J101	0.03967	-0.01468	0.04098	-0.09454	0.03327	-0.03316	0.07816
J102	-0.04116	-0.01887	0.05606	-0.03741	0.04166	0.09662	-0.04559
J103	-0.03185	0.01825	-0.09033	-0.03375	-0.01189	0.04329	0.02678
J104	0.04340	-0.00964	-0.01872	0.02991	-0.02790	-0.00075	0.02352
J105	-0.07573	-0.06095	0.04883	0.00955	0.06070	-0.05130	0.00092
J106	0.01135	0.03546	0.02439	0.00028	-0.06139	-0.01301	-0.08902
J107	0.00929	0.06567	-0.03147	-0.00550	0.05928	-0.02305	0.05237
J108	0.04796	-0.04527	-0.02204	-0.00543	-0.06320	-0.03656	0.04041
J109	-0.05670	0.01173	0.00395	0.04500	-0.04553	0.00482	0.05617
J110	0.02840	-0.12679	-0.04172	0.04508	-0.01719	-0.01967	0.09785
J111	-0.02615	-0.01353	-0.02827	0.04093	-0.05396	0.02832	-0.00904
J112	0.02625	-0.00570	0.03827	0.00360	0.08596	0.07878	0.03475
J113	-0.08318	-0.01525	-0.08402	0.02019	-0.04218	-0.00704	0.05388
J114	0.05083	0.02419	-0.08272	0.06995	-0.00915	-0.08386	-0.08482
J115	-0.00270	0.11454	-0.00688	0.11560	-0.01509	-0.00595	-0.04904
J116	0.06862	-0.02714	0.02758	-0.03430	0.02945	-0.01107	0.09162
J117	0.02193	0.00235	-0.06264	-0.04128	-0.00311	-0.07324	-0.00683
J118	0.05866	0.05967	0.03641	-0.02768	-0.00907	-0.08797	0.04517
J119	0.03065	-0.03730	0.02167	0.01571	0.03568	-0.04076	-0.00324
J120	0.02585	-0.03668	0.04992	0.01480	0.01015	0.07868	0.09087
J121	-0.01741	0.01444	0.00654	0.01740	0.00730	0.00730	0.03545
J122	0.00149	0.04494	0.04470	0.02338	0.10016	-0.03543	0.05126
J123	0.00317	-0.00392	0.09064	0.01421	-0.03041	-0.00356	-0.14452
J124	0.04768	0.00912	0.00027	0.01104	-0.05361	-0.02614	-0.01633
J125	-0.02591	-0.03661	-0.00137	-0.01793	0.03734	0.06656	-0.03456
J126	0.06048	0.04526	-0.02560	-0.00006	0.08225	0.11737	-0.00670
J127	-0.04749	-0.01741	0.04506	0.08804	-0.03153	0.06209	-0.06599
J128	0.02203	-0.03992	-0.01260	-0.08900	-0.00099	-0.09363	-0.11699
J129	0.01425	-0.02932	0.00959	0.11305	0.03481	0.08116	-0.02938
J130	0.05634	0.04182	-0.01875	0.08181	-0.01575	-0.02079	-0.00466
J131	0.02279	0.03474	-0.10097	-0.10025	-0.07405	0.06246	-0.07642
J132	-0.03436	0.02465	-0.02948	-0.03046	-0.11675	-0.06053	0.11022
J133	-0.00828	0.05184	0.01661	0.00295	0.03718	0.01218	0.00314
J134	-0.03248	-0.03096	-0.03674	0.07632	-0.09120	-0.02364	0.00428
J135	-0.05981	0.02893	-0.06157	-0.13013	0.07908	-0.02942	-0.02890
J136	0.00090	-0.08752	0.01253	-0.04172	0.02396	0.01290	-0.01038
J137	-0.04886	0.05182	-0.04247	0.04102	0.13360	-0.06758	0.05159
J139	0.04992	0.01861	0.03457	0.02546	-0.05084	-0.02219	-0.01741
J140	0.01846	0.04993	0.03985	-0.02348	-0.07625	0.13063	0.02503
J141	-0.02777	0.01835	0.08077	-0.00122	-0.03233	-0.02393	-0.07554
J142	0.01869	0.03079	0.04107	-0.05189	0.01381	-0.06124	0.01891
J143	0.03831	-0.06934	0.01930	0.02828	-0.05182	0.04480	0.10928
J144	0.01105	-0.06244	-0.01595	-0.00209	0.07664	-0.10303	-0.06403
J145	-0.04011	0.03124	0.04624	-0.03349	-0.05082	-0.08281	0.01236
J146	0.00383	0.02570	0.08384	-0.06616	-0.09719	0.05261	0.00198
J147	-0.02344	-0.06773	-0.03367	0.01424	-0.06476	0.01499	-0.11870
J148	-0.00509	-0.00498	0.04282	0.00967	0.00041	-0.09083	-0.02084
J149	-0.02393	0.00388	-0.03481	-0.04348	0.02212	0.04693	0.06643
J150	0.01418	-0.00461	-0.07884	0.12076	0.09868	0.04591	-0.05125
J151	0.03486	0.00698	-0.04201	-0.01860	0.00876	0.03999	0.02428
J152	-0.02010	0.03225	0.08706	0.01963	0.06624	-0.01318	-0.02930
J153	-0.02442	0.03352	-0.03887	-0.10427	0.00833	0.12481	-0.03722
J154	0.02488	0.03578	-0.00507	0.02548	-0.00933	0.05268	0.04737
J155	-0.08756	-0.00218	0.03694	0.03842	-0.02128	-0.02036	0.11439
J156	0.01180	-0.09271	0.00200	-0.03976	0.05506	0.03536	-0.06906

TABLE 5-9 (Continued)

ITEM	FACTOR 50	FACTOR 51	FACTOR 52	FACTOR 53	FACTOR 54	FACTOR 55
J101	0.03142	0.08503	-0.08541	0.03466	-0.04517	0.07272
J102	0.02207	0.01248	0.07447	-0.05042	0.02570	-0.11835
J103	-0.11117	-0.01416	0.06125	0.11280	-0.13397	-0.03643
J104	-0.04373	0.05862	-0.13490	0.08246	0.08054	0.06797
J105	0.05133	-0.00373	0.02756	-0.02744	-0.00589	0.12547
J106	-0.04144	-0.08182	0.08166	0.00424	0.04386	0.14398
J107	0.04660	0.05344	-0.01937	-0.15265	0.07909	-0.00817
J108	-0.08513	-0.18616	-0.06582	0.08115	0.05689	-0.05921
J109	-0.02641	-0.10130	0.05861	0.04389	0.01260	-0.08387
J110	0.15721	-0.01742	0.08529	0.02682	0.05081	0.03369
J111	-0.08266	0.07870	-0.09197	-0.05516	0.09025	-0.07117
J112	0.05415	-0.01380	-0.06075	-0.08624	0.10397	-0.10237
J113	-0.01280	-0.06726	-0.07862	-0.08339	-0.05319	-0.01954
J114	-0.04658	0.04429	0.10699	-0.03441	0.08957	0.01116
J115	0.08594	-0.01741	-0.01366	-0.08415	-0.01917	0.04524
J116	0.04879	-0.00032	-0.01978	-0.11514	-0.00405	-0.08924
J117	-0.04519	0.09673	-0.03875	-0.12613	0.08848	0.03994
J118	0.03942	-0.13202	0.01867	0.08638	0.05083	-0.01314
J119	-0.07478	0.07982	-0.08409	0.10063	-0.08984	-0.09396
J120	-0.00390	-0.09616	-0.04332	-0.00418	0.07287	0.11241
J121	-0.06925	0.00847	0.05974	-0.01966	0.05165	0.09216
J122	-0.09174	0.07934	0.04863	-0.01573	-0.12476	0.01965
J123	0.09639	-0.06017	-0.02170	-0.03848	0.07087	-0.10473
J124	0.05126	-0.06057	0.12736	-0.01713	-0.07459	0.05804
J125	0.04580	0.09325	0.00841	0.03954	0.06247	0.12120
J126	0.01681	-0.04292	0.05232	-0.05936	-0.03985	-0.12571
J127	0.07379	0.06662	0.00998	0.11383	0.05983	-0.04711
J128	0.04017	-0.09433	-0.06346	-0.01769	-0.03369	-0.06096
J129	-0.03058	-0.06256	0.02127	-0.10532	-0.09966	-0.06773
J130	0.08399	0.02617	-0.11058	0.10914	-0.12982	-0.06070
J131	-0.04651	0.01535	0.02312	-0.07293	0.00428	0.07853
J132	0.11942	0.04390	-0.01046	-0.01132	0.03355	-0.04073
J133	-0.04100	-0.00267	0.13904	0.16533	0.03936	0.08781
J134	0.01715	0.02824	0.00784	-0.02108	0.15429	0.05025
J135	0.09387	0.03236	-0.07191	0.04692	-0.00793	0.01305
J136	0.04402	0.07838	0.08740	0.01060	-0.10131	0.05218
J137	0.03037	-0.08230	-0.02050	0.11924	0.00578	-0.03104
J139	-0.04033	0.08924	-0.07873	0.00571	-0.04392	-0.10324
J140	0.06283	0.03732	-0.10699	0.09012	0.00379	0.09505
J141	-0.00018	-0.05639	-0.05082	-0.08559	-0.10545	0.09828
J142	0.01883	0.00997	0.06385	0.07754	0.14243	-0.08691
J143	-0.07526	0.02134	0.05948	0.01617	-0.11427	0.03446
J144	-0.05995	0.01750	0.10847	-0.07679	0.00949	-0.06924
J145	0.04148	0.12978	0.07766	0.03365	-0.07629	-0.12602
J146	-0.10470	0.06798	0.02930	-0.10032	-0.00694	-0.02018
J147	0.08991	0.01315	-0.03166	0.05248	-0.15273	-0.03457
J148	-0.09003	-0.01308	-0.05925	0.01679	-0.06427	0.12805
J149	0.02721	-0.04232	-0.08614	-0.10824	-0.05631	0.09493
J150	-0.01912	0.05708	-0.08504	0.03127	0.00598	0.04182
J151	0.09117	-0.08459	0.10140	-0.06122	-0.10561	0.09237
J152	-0.02202	-0.04100	-0.06313	-0.00054	0.02306	0.14314
J153	-0.04012	-0.07298	0.01189	0.10280	0.03694	-0.10717
J154	0.04657	0.13107	0.13752	0.04719	0.05026	0.00714
J155	-0.07563	-0.04006	0.00230	-0.06700	0.01859	-0.11677
J156	-0.07183	-0.00912	-0.01794	0.06291	0.14311	0.00796

TABLE 5-10

Factor Loading Matrix for the Fifty-Five Items of Test J1 in the J1/2259 Case.

ITEM	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
J101	0.591	-0.194	0.109	0.055	-0.057	-0.142	-0.015
J102	0.476	-0.103	-0.059	-0.150	-0.079	0.053	0.177
J103	0.497	-0.189	-0.088	-0.049	0.088	-0.054	0.265
J104	0.582	0.078	-0.208	-0.058	0.025	-0.004	-0.051
J105	0.625	0.127	-0.019	-0.028	0.090	0.074	-0.046
J106	0.447	0.052	-0.176	-0.125	0.063	-0.121	0.126
J107	0.507	0.011	-0.199	-0.003	0.231	0.112	-0.108
J108	0.614	0.092	0.066	-0.194	-0.294	0.369	0.106
J109	0.363	-0.132	-0.187	-0.133	0.218	-0.147	-0.020
J110	0.500	0.387	-0.150	-0.061	0.187	-0.283	0.048
J111	0.692	-0.097	0.009	-0.184	-0.126	-0.023	-0.064
J112	0.403	-0.223	-0.038	-0.047	-0.209	-0.080	-0.054
J113	0.456	-0.054	-0.046	-0.039	-0.024	0.084	0.157
J114	0.430	0.067	0.146	0.103	-0.084	-0.051	-0.034
J115	0.579	-0.143	0.050	0.110	-0.146	0.031	-0.075
J116	0.292	-0.045	-0.032	-0.023	0.044	0.208	0.181
J117	0.366	0.224	-0.066	-0.052	0.001	-0.077	0.014
J118	0.507	-0.400	-0.078	-0.028	0.130	-0.183	0.107
J119	0.550	-0.136	-0.261	-0.002	0.180	-0.022	-0.131
J120	0.283	-0.064	0.170	0.038	-0.150	-0.022	-0.091
J121	0.428	-0.043	-0.045	-0.073	0.010	-0.007	0.118
J122	0.414	-0.070	0.017	0.022	-0.075	-0.129	0.095
J123	0.418	-0.057	0.019	-0.040	-0.015	-0.042	0.023
J124	0.493	-0.072	-0.123	0.023	0.236	0.260	-0.040
J125	0.413	-0.042	-0.134	-0.185	0.050	-0.006	0.010
J126	0.347	0.109	0.052	-0.046	-0.141	-0.028	-0.106
J127	0.468	-0.195	-0.104	-0.125	0.058	0.137	-0.098
J128	0.565	-0.072	0.045	-0.098	-0.155	0.067	0.121
J129	0.609	0.022	-0.054	0.144	0.165	0.095	-0.120
J130	0.334	0.282	-0.023	-0.098	-0.112	-0.192	0.112
J131	0.627	-0.270	0.021	-0.020	-0.058	-0.069	-0.160
J132	0.309	-0.052	0.074	0.084	-0.100	0.052	-0.167
J133	0.638	0.211	-0.139	-0.232	-0.219	0.114	-0.179
J134	0.291	-0.161	0.086	0.136	-0.053	-0.147	0.219
J135	0.651	0.136	-0.108	-0.057	0.088	0.044	0.036
J136	0.348	-0.083	-0.151	0.085	-0.150	-0.045	-0.110
J137	0.512	0.025	0.053	0.048	0.030	0.100	-0.220
J139	0.354	0.113	0.015	0.146	0.167	-0.076	0.201
J140	0.392	0.007	0.582	-0.254	0.360	-0.025	-0.119
J141	0.496	0.624	0.018	-0.065	-0.098	-0.050	-0.032
J142	0.411	0.164	-0.004	0.095	-0.105	-0.207	-0.031
J143	0.509	0.113	0.123	0.015	-0.063	0.050	-0.009
J144	0.361	0.019	0.659	-0.282	0.261	-0.032	0.013
J145	0.535	-0.093	0.236	-0.072	-0.305	-0.095	0.036
J146	0.664	0.136	-0.139	0.003	0.097	0.070	-0.124
J147	0.318	-0.097	0.099	0.336	0.040	0.028	-0.129
J148	0.465	-0.164	0.079	0.033	-0.013	0.054	0.057
J149	0.457	0.019	-0.056	-0.059	0.030	-0.076	0.189
J150	0.459	0.012	0.067	-0.006	-0.013	0.031	0.058
J151	0.422	-0.104	0.105	0.221	-0.087	0.002	0.121
J152	0.369	-0.088	0.031	0.238	-0.146	-0.079	0.038
J153	0.361	0.401	0.097	0.358	0.017	-0.120	0.071
J154	0.237	0.183	0.097	0.260	0.076	0.418	0.330
J155	0.597	0.052	0.082	0.391	0.033	0.025	-0.198
J156	0.551	-0.134	0.010	0.337	0.166	-0.041	0.039

TABLE 5-10 (Continued)

ITEM	FACTOR 8	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13	FACTOR 14
J101	-0.081	-0.060	-0.145	-0.161	0.189	-0.118	0.088
J102	-0.087	-0.100	-0.095	0.014	-0.057	-0.061	0.108
J103	-0.011	-0.149	0.062	-0.085	0.237	-0.059	-0.014
J104	-0.094	0.107	0.157	0.068	0.057	-0.032	0.009
J105	-0.043	0.006	-0.107	0.053	0.058	0.021	0.074
J106	0.088	-0.163	0.039	0.344	0.120	-0.115	0.225
J107	-0.028	0.065	0.080	-0.021	0.003	0.091	-0.022
J108	0.219	-0.070	-0.009	0.036	0.029	0.232	-0.041
J109	-0.046	0.126	-0.261	-0.015	-0.009	0.107	0.112
J110	0.216	-0.045	-0.013	-0.159	0.065	0.088	-0.042
J111	-0.048	0.054	-0.176	-0.130	-0.033	0.023	0.018
J112	-0.164	0.038	-0.063	0.109	0.022	-0.093	0.008
J113	-0.162	0.017	0.314	0.051	-0.121	0.098	0.128
J114	-0.120	0.164	0.067	-0.062	0.014	0.019	0.059
J115	0.210	-0.104	0.112	-0.026	0.065	-0.031	0.011
J116	0.123	-0.130	0.056	0.031	-0.032	-0.053	-0.006
J117	-0.096	-0.250	-0.157	0.143	-0.072	0.124	-0.019
J118	-0.254	-0.172	0.119	-0.046	-0.055	0.126	-0.166
J119	0.094	0.120	0.068	0.206	-0.126	0.134	0.106
J120	-0.014	0.089	-0.128	-0.076	-0.106	0.231	-0.012
J121	0.038	-0.065	-0.001	-0.031	-0.101	-0.095	-0.011
J122	-0.028	0.048	0.045	-0.060	0.111	0.276	-0.178
J123	0.063	0.026	0.017	-0.056	0.099	0.043	0.069
J124	0.141	0.186	-0.109	-0.174	-0.087	0.031	0.035
J125	0.034	-0.037	0.092	-0.035	0.086	-0.119	-0.042
J126	0.023	-0.089	0.085	-0.145	0.010	-0.074	-0.002
J127	-0.002	0.126	-0.105	0.061	0.078	0.104	-0.048
J128	-0.104	0.051	0.060	-0.094	0.136	-0.055	-0.056
J129	0.018	-0.224	0.035	-0.062	-0.237	-0.024	-0.183
J130	-0.075	0.104	-0.181	0.149	0.081	0.042	0.015
J131	0.127	0.038	-0.013	0.200	0.111	-0.028	-0.163
J132	-0.084	-0.185	0.065	0.138	-0.068	-0.010	-0.056
J133	-0.228	0.123	0.162	-0.104	-0.112	-0.177	0.146
J134	-0.061	0.132	0.102	-0.168	-0.148	-0.141	-0.078
J135	0.001	-0.081	-0.033	-0.135	-0.111	-0.033	0.029
J136	0.140	0.055	0.219	0.023	0.085	0.168	0.172
J137	-0.005	0.003	-0.172	0.157	-0.046	-0.268	-0.120
J139	-0.023	-0.018	-0.055	0.024	-0.160	-0.118	0.049
J140	-0.040	-0.050	0.103	0.060	-0.015	0.032	0.044
J141	-0.216	-0.021	-0.077	-0.091	0.026	0.088	-0.102
J142	-0.023	-0.052	0.112	0.152	0.022	0.061	-0.174
J143	0.007	-0.084	-0.094	0.073	-0.021	-0.089	-0.042
J144	0.002	0.102	0.114	0.049	0.024	0.008	0.090
J145	0.281	0.023	-0.095	0.049	-0.154	-0.027	-0.037
J146	-0.002	-0.029	0.071	-0.107	-0.039	-0.077	-0.071
J147	-0.233	0.038	0.047	0.074	0.053	0.109	-0.095
J148	0.112	-0.108	-0.030	-0.053	-0.068	0.008	-0.124
J149	0.168	0.401	0.045	0.053	-0.002	-0.161	-0.236
J150	0.031	0.002	-0.062	0.011	-0.009	0.044	0.041
J151	-0.000	-0.082	-0.093	-0.113	-0.124	0.105	0.302
J152	-0.100	0.140	-0.012	0.153	-0.202	-0.038	0.121
J153	0.213	0.062	0.161	0.045	-0.097	0.013	0.048
J154	-0.189	0.100	-0.062	0.156	0.186	0.024	-0.071
J155	0.064	-0.043	0.004	-0.127	0.358	-0.102	0.138
J156	0.012	0.013	-0.175	0.018	-0.029	-0.006	0.017

TABLE 5-10 (Continued)

ITEM	FACTOR 15	FACTOR 16	FACTOR 17	FACTOR 18	FACTOR 19	FACTOR 20	FACTOR 21
J101	-0.036	-0.095	-0.035	0.043	-0.132	-0.099	0.036
J102	-0.005	0.178	0.144	-0.146	-0.089	-0.093	-0.078
J103	0.036	0.125	0.044	0.108	0.209	0.014	0.009
J104	-0.063	0.058	0.049	-0.014	-0.062	0.085	-0.028
J105	0.001	-0.020	-0.006	-0.141	-0.133	-0.105	-0.047
J106	-0.088	0.070	-0.016	0.037	-0.126	-0.004	-0.051
J107	0.049	0.028	-0.023	-0.018	-0.037	-0.060	0.053
J108	0.078	-0.012	-0.143	0.049	-0.121	-0.102	-0.105
J109	-0.023	0.052	-0.101	-0.030	-0.147	0.172	-0.074
J110	-0.143	0.081	-0.004	-0.122	0.192	-0.116	0.021
J111	-0.180	0.047	-0.099	-0.160	0.052	-0.063	-0.014
J112	0.011	0.150	-0.208	0.041	0.100	-0.195	0.184
J113	-0.164	-0.151	0.129	0.100	-0.042	-0.018	0.159
J114	-0.134	0.160	-0.025	0.150	-0.096	0.073	-0.099
J115	0.016	0.135	0.168	-0.149	0.066	0.086	0.007
J116	0.180	0.043	-0.060	0.066	-0.050	0.070	0.056
J117	0.165	0.033	-0.058	-0.025	0.100	0.055	-0.070
J118	0.054	-0.009	-0.026	-0.116	0.032	0.032	-0.054
J119	-0.078	-0.013	-0.017	-0.004	0.035	0.134	0.044
J120	-0.022	0.113	0.263	0.059	0.060	0.169	-0.173
J121	0.031	-0.087	0.104	0.008	-0.154	0.012	0.099
J122	-0.080	0.089	-0.010	0.246	-0.067	-0.182	-0.083
J123	-0.130	-0.112	0.056	0.124	0.038	0.030	-0.039
J124	0.124	0.241	0.095	0.066	-0.046	-0.026	0.249
J125	0.010	0.089	-0.122	0.213	-0.016	0.185	-0.007
J126	-0.132	0.002	-0.032	-0.113	-0.204	0.163	0.002
J127	0.087	-0.204	0.017	0.040	0.145	0.003	0.066
J128	0.061	0.043	0.139	-0.107	0.024	0.052	0.072
J129	0.019	-0.080	0.006	0.066	0.010	-0.096	-0.122
J130	0.262	-0.110	0.081	0.096	-0.061	-0.030	0.020
J131	-0.029	-0.105	0.120	0.083	0.081	0.035	0.007
J132	-0.070	0.126	0.017	0.068	0.005	-0.004	-0.019
J133	0.140	-0.102	-0.001	0.034	0.116	-0.041	-0.138
J134	0.160	-0.052	-0.014	-0.045	-0.073	0.015	-0.049
J135	0.096	-0.072	-0.048	0.080	0.057	0.078	-0.157
J136	0.121	-0.071	0.046	-0.206	0.068	-0.095	-0.031
J137	-0.188	-0.012	0.130	0.058	0.033	-0.066	-0.027
J139	-0.012	0.048	0.176	0.025	0.099	-0.047	-0.011
J140	0.019	-0.002	-0.057	-0.032	-0.009	-0.031	-0.061
J141	-0.024	-0.022	0.015	0.022	0.040	0.139	0.240
J142	0.019	-0.129	0.036	-0.086	-0.092	0.035	0.113
J143	0.028	0.036	0.066	-0.000	-0.020	0.038	0.071
J144	0.079	-0.002	-0.010	-0.014	0.065	-0.016	0.061
J145	0.017	0.033	-0.025	0.013	0.041	0.005	0.064
J146	-0.084	-0.012	-0.092	-0.017	-0.003	-0.164	0.005
J147	0.088	0.152	-0.038	-0.054	-0.142	-0.045	0.044
J148	-0.091	-0.109	-0.236	-0.080	0.009	0.200	0.111
J149	-0.056	-0.067	-0.070	-0.068	-0.034	-0.022	-0.123
J150	0.012	-0.027	0.060	-0.127	-0.053	-0.001	0.005
J151	-0.199	-0.186	-0.045	0.089	0.056	-0.039	0.070
J152	0.085	0.114	-0.209	-0.025	0.171	0.073	-0.009
J153	0.022	0.106	-0.073	0.058	-0.038	-0.039	-0.003
J154	-0.183	-0.029	-0.045	-0.123	0.124	0.065	-0.083
J155	0.150	-0.051	-0.066	0.028	0.036	0.085	-0.059
J156	0.098	-0.168	0.059	0.015	-0.088	-0.050	-0.006

TABLE 5-10 (Continued)

ITEM	FACTOR 22	FACTOR 23	FACTOR 24	FACTOR 25	FACTOR 26	FACTOR 27	FACTOR 28
J101	0.189	0.165	-0.023	-0.220	0.084	0.012	0.065
J102	0.007	0.041	-0.086	-0.075	-0.098	-0.022	-0.103
J103	-0.151	0.022	0.093	0.041	0.167	-0.032	0.125
J104	-0.145	0.032	0.060	-0.102	0.070	0.087	-0.071
J105	0.030	-0.080	-0.038	-0.090	-0.047	0.018	-0.009
J106	-0.040	0.011	0.042	0.028	-0.046	-0.007	0.051
J107	-0.083	-0.005	-0.032	-0.045	0.026	-0.028	0.092
J108	-0.060	-0.042	0.021	-0.003	0.130	-0.096	-0.025
J109	0.071	0.006	-0.019	0.031	0.181	-0.013	0.040
J110	-0.027	-0.071	-0.119	-0.047	-0.088	-0.108	-0.043
J111	-0.002	0.077	0.012	0.132	-0.062	0.014	0.063
J112	0.090	-0.097	0.024	0.039	0.024	-0.082	-0.108
J113	0.095	-0.137	-0.140	-0.106	-0.058	0.010	0.155
J114	-0.096	-0.161	-0.054	-0.061	0.090	-0.085	-0.078
J115	0.276	-0.113	0.061	0.098	0.063	0.004	0.103
J116	-0.011	0.130	-0.095	-0.034	-0.025	0.009	-0.119
J117	0.098	-0.032	-0.007	0.019	-0.008	0.194	0.102
J118	-0.058	-0.080	-0.027	-0.050	-0.064	0.053	-0.072
J119	0.124	0.092	0.129	0.077	-0.060	0.062	-0.160
J120	-0.008	-0.004	0.074	-0.075	-0.075	-0.117	0.014
J121	0.023	0.025	-0.004	0.123	0.068	-0.084	-0.045
J122	0.137	0.096	-0.043	0.153	-0.077	0.083	0.034
J123	0.006	0.100	-0.004	-0.067	0.065	0.032	-0.036
J124	0.006	0.037	-0.018	0.012	-0.040	0.043	-0.004
J125	0.080	-0.117	0.100	-0.023	-0.076	0.002	0.009
J126	-0.169	0.071	-0.031	0.069	-0.096	-0.029	0.136
J127	-0.144	-0.005	-0.068	-0.004	-0.045	0.021	0.151
J128	-0.088	0.086	-0.009	0.049	-0.044	0.143	0.022
J129	0.006	0.101	0.021	-0.088	0.067	0.046	-0.044
J130	-0.067	0.018	0.032	0.040	-0.131	-0.133	-0.006
J131	0.035	0.085	-0.116	-0.099	-0.082	-0.112	-0.109
J132	-0.111	0.135	-0.128	0.208	0.016	-0.023	-0.020
J133	0.125	-0.064	-0.105	0.097	0.014	0.012	-0.011
J134	0.046	0.114	0.144	0.023	-0.024	-0.052	-0.041
J135	0.040	-0.044	0.071	-0.011	-0.056	-0.078	0.022
J136	-0.030	0.074	0.063	0.008	0.174	-0.101	-0.019
J137	-0.012	0.038	0.050	0.016	0.070	-0.013	0.075
J139	-0.044	-0.084	-0.107	0.047	0.130	-0.080	-0.089
J140	-0.020	0.005	-0.059	0.029	0.090	0.065	-0.030
J141	0.036	0.090	0.002	-0.007	0.164	0.038	-0.088
J142	-0.004	-0.030	0.106	0.006	0.044	-0.010	-0.030
J143	-0.016	-0.087	0.084	0.022	-0.086	-0.029	0.050
J144	0.031	0.043	0.114	0.029	-0.059	-0.078	0.019
J145	-0.083	-0.165	0.041	-0.175	0.048	0.228	-0.029
J146	-0.067	-0.006	0.253	-0.081	-0.107	-0.054	0.020
J147	-0.039	-0.119	0.037	0.006	-0.005	-0.021	0.009
J148	0.055	-0.049	-0.145	0.026	-0.013	-0.192	0.002
J149	-0.030	-0.055	-0.077	0.111	0.034	0.126	-0.007
J150	0.008	0.045	-0.066	-0.022	-0.045	0.066	-0.038
J151	-0.131	-0.023	0.115	0.135	-0.053	0.094	-0.108
J152	-0.088	0.165	-0.064	-0.122	-0.007	-0.044	0.139
J153	0.071	0.114	-0.059	-0.019	-0.044	0.028	0.124
J154	0.117	0.030	0.076	-0.032	-0.021	-0.019	-0.030
J155	-0.038	-0.065	-0.104	0.039	-0.104	0.091	-0.134
J156	-0.021	-0.136	-0.006	0.104	0.060	-0.013	0.104

TABLE 5-10 (Continued)

ITEM	FACTOR 29	FACTOR 30	FACTOR 31	FACTOR 32	FACTOR 33	FACTOR 34	FACTOR 35
J101	-0.057	-0.154	-0.000	0.000	-0.081	-0.077	-0.054
J102	-0.100	-0.034	-0.099	-0.065	-0.142	0.018	0.046
J103	-0.057	-0.002	0.097	-0.062	-0.010	-0.050	-0.060
J104	-0.034	0.103	-0.075	-0.030	-0.082	0.119	0.050
J105	0.063	0.044	0.061	0.021	0.081	0.045	-0.035
J106	0.150	-0.087	-0.004	-0.048	0.010	0.010	0.030
J107	-0.026	-0.016	-0.049	0.053	-0.088	-0.027	-0.011
J108	-0.045	-0.025	-0.094	-0.072	0.040	0.027	-0.037
J109	-0.038	0.154	-0.087	0.074	0.027	-0.059	-0.031
J110	-0.028	0.035	-0.032	-0.079	0.072	-0.058	0.055
J111	0.243	0.011	0.139	-0.068	-0.101	0.054	-0.047
J112	-0.018	-0.020	-0.013	-0.014	0.153	-0.015	-0.053
J113	-0.003	-0.031	0.022	-0.041	0.063	-0.030	-0.020
J114	-0.043	0.020	0.221	0.032	-0.031	0.004	-0.061
J115	-0.041	0.141	-0.026	0.034	-0.047	-0.011	-0.098
J116	0.051	0.114	0.103	-0.048	-0.040	-0.115	-0.053
J117	-0.205	-0.091	0.080	-0.030	0.030	0.155	-0.043
J118	0.124	-0.039	0.006	0.114	-0.027	0.019	-0.017
J119	-0.068	-0.127	0.061	-0.048	0.046	-0.091	-0.026
J120	0.014	-0.135	0.032	-0.015	0.011	-0.066	-0.005
J121	0.010	-0.065	0.135	0.058	0.057	-0.003	0.046
J122	-0.000	0.080	-0.038	-0.015	0.012	-0.012	0.125
J123	-0.064	-0.005	-0.002	0.006	0.047	0.059	0.141
J124	0.010	-0.020	0.060	-0.048	0.013	0.070	0.037
J125	0.099	-0.006	-0.121	0.083	-0.011	0.069	0.046
J126	-0.032	-0.004	-0.064	-0.072	0.179	-0.014	-0.103
J127	-0.007	-0.082	-0.021	-0.041	-0.013	0.034	-0.061
J128	-0.016	0.080	0.019	0.098	0.062	0.008	0.043
J129	0.102	0.053	0.009	-0.039	-0.020	-0.055	-0.052
J130	-0.016	0.065	0.099	0.127	-0.052	0.012	-0.036
J131	0.015	0.143	-0.044	-0.009	0.060	0.101	-0.133
J132	-0.027	-0.119	-0.077	0.155	-0.006	-0.086	-0.005
J133	-0.007	0.057	-0.003	-0.010	-0.054	-0.043	0.035
J134	-0.029	-0.040	-0.027	-0.093	0.137	0.132	0.012
J135	0.073	-0.022	-0.024	-0.074	0.045	-0.018	0.014
J136	0.089	-0.083	0.031	0.079	0.014	0.061	0.092
J137	-0.011	0.013	0.029	-0.036	-0.002	0.100	0.090
J139	-0.016	-0.056	-0.111	0.020	0.019	0.063	-0.062
J140	-0.040	0.058	0.127	-0.020	0.100	0.020	0.057
J141	0.117	-0.068	-0.099	0.003	0.009	-0.004	-0.027
J142	-0.054	0.092	0.059	-0.168	-0.111	-0.087	0.032
J143	-0.026	0.008	0.015	-0.035	-0.028	-0.105	0.134
J144	0.021	-0.031	-0.149	-0.005	-0.105	-0.020	-0.042
J145	0.100	-0.038	-0.012	0.083	0.028	-0.049	0.043
J146	-0.168	0.011	0.025	0.195	0.015	-0.050	-0.027
J147	0.006	-0.040	-0.065	-0.117	-0.034	0.047	-0.004
J148	-0.096	-0.044	0.048	0.058	-0.127	0.106	0.127
J149	-0.071	-0.137	-0.017	-0.030	-0.073	-0.073	-0.071
J150	-0.082	0.039	-0.049	0.103	0.078	-0.059	0.024
J151	-0.066	0.110	-0.054	-0.017	-0.092	0.059	-0.077
J152	-0.024	0.106	-0.033	-0.049	0.029	-0.080	0.087
J153	0.063	-0.011	0.033	0.108	-0.059	0.110	-0.080
J154	0.059	0.005	0.024	0.057	0.058	-0.025	0.006
J155	-0.002	-0.081	0.000	-0.047	0.009	-0.025	0.027
J156	0.092	0.050	-0.075	0.024	0.049	-0.067	0.069

TABLE 5-10 (Continued)

ITEM	FACTOR 36	FACTOR 37	FACTOR 38	FACTOR 39	FACTOR 40	FACTOR 41	FACTOR 42
J101	0.023	0.022	-0.020	-0.062	-0.024	0.040	0.045
J102	0.003	-0.133	-0.020	0.034	-0.069	-0.004	-0.023
J103	-0.071	0.018	0.018	0.022	-0.055	-0.085	-0.024
J104	0.038	0.140	-0.066	0.016	-0.088	0.052	0.055
J105	0.030	0.131	-0.011	-0.027	-0.081	-0.075	-0.019
J106	-0.145	0.013	-0.026	-0.001	0.085	0.050	-0.005
J107	-0.054	-0.031	0.116	-0.044	-0.093	-0.033	0.042
J108	0.032	-0.020	-0.040	-0.045	0.017	0.004	-0.025
J109	-0.040	0.040	-0.010	0.006	0.107	-0.055	-0.013
J110	0.022	0.020	-0.027	-0.091	0.027	0.037	-0.012
J111	0.079	-0.035	0.013	-0.028	0.046	-0.035	-0.001
J112	-0.033	0.097	0.004	0.110	-0.067	0.053	-0.011
J113	0.038	-0.013	-0.052	-0.021	0.057	-0.067	-0.044
J114	0.041	-0.097	0.002	-0.034	-0.008	0.095	-0.060
J115	-0.012	-0.057	-0.057	-0.012	-0.003	0.058	0.030
J116	0.013	0.021	0.177	-0.029	0.053	0.033	-0.005
J117	0.085	0.010	0.034	0.019	0.018	-0.021	-0.044
J118	-0.053	-0.050	0.017	0.075	0.005	0.011	-0.008
J119	0.016	-0.010	0.041	-0.112	-0.068	0.030	-0.028
J120	-0.051	0.122	0.026	0.035	-0.018	-0.028	0.015
J121	0.182	0.045	-0.001	0.075	0.006	-0.025	0.108
J122	0.001	0.013	0.060	-0.022	-0.034	-0.019	0.059
J123	-0.019	-0.002	0.035	0.127	0.087	0.025	-0.066
J124	-0.080	-0.026	-0.121	0.073	0.028	-0.041	-0.007
J125	0.136	-0.068	-0.001	-0.057	-0.052	-0.056	0.000
J126	-0.029	-0.000	0.069	0.044	-0.071	-0.030	0.007
J127	-0.021	-0.030	-0.010	-0.035	0.004	0.113	0.070
J128	0.071	0.118	-0.021	-0.097	0.055	0.107	-0.057
J129	0.008	0.080	-0.098	0.004	-0.014	-0.008	-0.091
J130	-0.041	-0.022	-0.071	-0.049	-0.015	-0.030	-0.008
J131	0.016	-0.056	0.017	0.048	0.012	-0.045	-0.008
J132	-0.014	0.001	-0.136	-0.050	0.025	-0.015	0.005
J133	-0.135	0.046	0.056	-0.008	0.011	-0.031	0.006
J134	-0.110	-0.051	-0.021	-0.129	0.008	-0.015	-0.023
J135	0.031	-0.022	-0.050	0.099	0.029	0.112	0.095
J136	0.059	-0.040	0.047	0.030	-0.008	-0.034	-0.026
J137	-0.018	-0.038	0.089	-0.042	0.023	-0.011	-0.017
J139	0.056	0.047	0.075	-0.073	0.042	-0.026	0.078
J140	-0.049	-0.087	-0.045	-0.015	-0.054	0.007	0.073
J141	-0.030	-0.105	0.018	0.019	-0.015	0.012	-0.032
J142	-0.032	0.001	-0.064	0.024	0.027	-0.042	0.057
J143	0.037	-0.000	0.064	0.049	-0.050	0.007	-0.052
J144	0.065	0.079	0.020	0.030	0.030	-0.007	-0.063
J145	-0.081	0.006	0.018	-0.060	0.015	-0.048	0.059
J146	0.002	-0.047	0.015	0.010	0.105	-0.018	0.014
J147	0.016	0.023	0.080	-0.017	0.143	0.017	0.023
J148	-0.099	0.097	-0.004	-0.030	-0.018	0.006	-0.019
J149	0.041	-0.010	-0.022	0.095	0.006	-0.018	-0.037
J150	-0.042	-0.062	0.064	0.074	0.014	0.025	0.016
J151	-0.011	0.002	0.004	0.017	-0.023	-0.010	0.015
J152	0.119	-0.053	-0.049	0.004	0.002	-0.032	0.023
J153	-0.052	0.040	0.037	0.075	-0.037	0.044	0.005
J154	-0.044	-0.009	-0.029	0.002	-0.018	-0.028	0.048
J155	0.026	-0.003	-0.037	0.003	0.036	-0.080	0.006
J156	0.017	-0.041	0.005	-0.008	-0.094	0.065	-0.090

presented in Tables 5-11 and 5-12, together with the proportion correct $\hat{p}_g$ and the normal deviate $\hat{\gamma}_g$, for each item. Comparison of these two tables reveals that these two sets of results are fairly consistent with each other. It is also observed that the estimation of both the discrimination and difficulty parameters has been substantially ameliorated by the addition of older examinees, i.e., 460 and 461 second graders of junior high schools, respectively, in the J1/1075 and J1/2259 Cases, the fact which is especially conspicuous in the estimated discrimination and difficulty parameters of items J154, J120 and J134 in these tables when they are compared with the corresponding values shown in Table 5-3.

VI. Scale Adjustment I

As was mentioned in the preceding section, the estimated item parameters obtained as the result of the Tetrachoric Method are based upon the ability scale whose origin and unit are set equal to the mean and the standard deviation of the ability distribution of each specific examinee group. The results shown in Tables 5-1 through 5-4, 5-11 and 5-12 in the preceding section, therefore, are not directly comparable with one another. In order to make them comparable, we need some appropriate scale adjustment, or equating, so that all the estimated item characteristic functions be put on the single ability scale.

As we can see in Table 3-1, there are a certain number of test items which belong to the two tests of each pair of adjacent tests.

TABLE 5-11

Estimates of the Item Discrimination And Difficulty Parameters of Each of the 55 Items of Test J1, Together with Its Proportion Correct And Normal Deviate. J1/1075 Case.

Item g	Discrimination Parameter $\hat{a}_g$	Difficulty Parameter $\hat{b}_g$	Proportion Correct $\hat{p}_g$	Normal Deviate $\hat{\gamma}_g$
J101	0.771	-0.304	0.57356	-0.18545
J102	0.541	-1.036	0.68901	-0.49305
J103	0.642	-1.240	0.74860	-0.67009
J104	0.708	-1.125	0.74209	-0.64980
J105	0.783	-0.461	0.61173	-0.28383
J106	0.500	-0.934	0.66201	-0.41796
J107	0.567	-0.299	0.55866	-0.14757
J108	0.826	-2.102	0.90968	-1.33879
J109	0.330	-1.317	0.66015	-0.41287
J110	0.640	-0.724	0.65177	-0.39010
J111	0.983	-1.473	0.84916	-1.03284
J112	0.485	-0.916	0.65549	-0.40019
J113	0.554	-1.213	0.72160	-0.58760
J114	0.632	-0.096	0.52048	-0.05136
J115	0.815	-0.457	0.61359	-0.28869
J116	0.385	-1.221	0.66946	-0.43842
J117	0.354	-0.785	0.60335	-0.26203
J118	0.559	-1.273	0.73277	-0.62121
J119	0.614	-1.182	0.73184	-0.61839
J120	0.302	0.983	0.38827	0.28383
J121	0.499	-0.988	0.67039	-0.44099
J122	0.534	-1.030	0.68622	-0.48516
J123	0.528	-0.045	0.50838	-0.02101
J124	0.576	-1.859	0.82309	-0.92721
J125	0.522	-1.776	0.79423	-0.82119
J126	0.475	-0.805	0.63501	-0.34515
J127	0.543	-1.757	0.79888	-0.83763
J128	0.776	-1.141	0.75791	-0.69960
J129	0.793	1.131	0.24115	0.70261
J130	0.351	-1.988	0.74488	-0.65846
J131	0.876	-0.554	0.64246	-0.36504
J132	0.432	-0.248	0.53911	-0.09819
J133	0.732	-1.818	0.85847	-1.07347
J134	0.306	1.848	0.29423	0.54107
J135	0.836	-0.356	0.59032	-0.22837
J136	0.368	0.027	0.49628	0.00932
J137	0.682	-0.153	0.53445	-0.08646
J139	0.418	1.071	0.33985	0.41287
J140	0.420	-0.012	0.50186	-0.00466
J141	0.577	-1.115	0.71136	-0.55736
J142	0.499	0.120	0.47858	0.05372
J143	0.702	-0.435	0.59870	-0.24998
J144	0.389	-0.723	0.60335	-0.26203
J145	0.776	-0.499	0.62011	-0.30577
J146	0.865	-0.309	0.58007	-0.20207
J147	0.447	-0.000	0.50000	0.00000
J148	0.510	0.144	0.47393	0.06539
J149	0.514	-0.453	0.58194	-0.20686
J150	0.515	-0.332	0.56052	-0.15229
J151	0.486	0.666	0.38547	0.29115
J152	0.345	0.366	0.45251	0.11932
J153	0.463	1.187	0.30912	0.49835
J154	0.224	1.890	0.33985	0.41287
J155	0.860	0.744	0.31378	0.48516
J156	0.711	1.131	0.25605	0.65557

TABLE 5-12

Estimates of the Item Discrimination And Difficulty Parameters of Each of the 55 Items of Test J1, Together with Its Proportion Correct And Normal Deviate. J1/2259 Case.

Item g	Discrimination Parameter $\hat{a}_g$	Difficulty Parameter $\hat{b}_g$	Proportion Correct $\hat{p}_g$	Normal Deviate $\hat{\gamma}_g$
J101	0.733	-0.528	0.62240	-0.31179
J102	0.541	-1.240	0.72244	-0.59011
J103	0.573	-1.545	0.77866	-0.76768
J104	0.716	-1.094	0.73794	-0.63701
J105	0.801	-0.388	0.59584	-0.24259
J106	0.500	-1.027	0.67685	-0.45891
J107	0.588	-0.089	0.51793	-0.04496
J108	0.778	-2.249	0.91633	-1.38080
J109	0.390	-1.156	0.66268	-0.41979
J110	0.577	-0.617	0.62107	-0.30829
J111	0.959	-1.548	0.85790	-1.07093
J112	0.440	-1.319	0.70252	-0.53166
J113	0.512	-1.344	0.72997	-0.61272
J114	0.476	0.190	0.46746	0.08166
J115	0.710	-0.514	0.61709	-0.29785
J116	0.305	-1.949	0.71536	-0.56911
J117	0.393	-0.913	0.63081	-0.33400
J118	0.588	-1.851	0.82603	-0.93859
J119	0.659	-1.256	0.75520	-0.69095
J120	0.295	0.757	0.41523	0.21411
J121	0.474	-1.189	0.69456	-0.50882
J122	0.455	-1.321	0.70784	-0.54709
J123	0.460	-0.142	0.52368	-0.05939
J124	0.567	-1.594	0.78398	-0.78571
J125	0.453	-1.969	0.79194	-0.81317
J126	0.370	-0.712	0.59761	-0.24717
J127	0.530	-1.581	0.77025	-0.73967
J128	0.685	-1.377	0.78176	-0.77815
J129	0.768	1.112	0.24923	0.67691
J130	0.354	-2.115	0.76007	-0.70653
J131	0.805	-0.781	0.68792	-0.48996
J132	0.325	-0.131	0.51616	-0.04052
J133	0.829	-1.657	0.85480	-1.05724
J134	0.304	1.327	0.34971	0.38610
J135	0.858	-0.515	0.63125	-0.33517
J136	0.371	-0.030	0.50421	-0.01055
J137	0.596	0.036	0.49270	0.01830
J139	0.379	1.296	0.32315	0.45891
J140	0.426	-0.078	0.51217	-0.03051
J141	0.571	-0.975	0.68570	-0.48370
J142	0.451	-0.161	0.52634	-0.06607
J143	0.591	-0.392	0.57902	-0.19939
J144	0.387	-0.688	0.59805	-0.24830
J145	0.635	-0.767	0.65958	-0.41132
J146	0.888	-0.236	0.56220	-0.15655
J147	0.335	0.079	0.49004	0.02497
J148	0.525	-0.354	0.56529	-0.16440
J149	0.514	-0.399	0.57238	-0.18244
J150	0.517	-0.331	0.56043	-0.15206
J151	0.465	0.607	0.39885	0.25632
J152	0.397	0.182	0.47322	0.06718
J153	0.387	1.720	0.26737	0.62079
J154	0.244	2.041	0.31430	0.48370
J155	0.744	0.955	0.28420	0.57041
J156	0.660	1.163	0.26073	0.64110

To be more specific, for the three pairs of adjacent tests, A5 and A6, A6 and J1, and J1 and J2, there are 16, 16 and 20 such overlapping test items, respectively. Table 6-1 presents the two item numbers, which are expressed in the notation adopted in the present study, of each item which belongs to the two adjacent tests of each pair.

If we can find the best fitted line for the scatter diagram of the estimated difficulty parameters with respect to these overlapping items, then we shall be able to obtain the estimated distance between the means of the two ability distributions, and the ratio of the standard deviations of these two distributions. If we follow a similar procedure for the estimated discrimination parameters with the constraint that the fitted line pass $(0,0)$, then we shall obtain another estimate of the ratio of the standard deviations of the two ability distributions. Since in each scatter diagram both sets of observations include error, it is obvious that a simple linear regression method for fitting a linear relationship between the two sets of estimates is not appropriate. There have been developed many methods (e.g., Deming, 1943) which deal with such a situation, however. In the present study, we shall use an iterative method based upon the dominating principal component obtained for the two sets of observations.

Let $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ be two sets of estimated item discrimination parameters obtained upon the examinee groups 1 and 2, respectively, where g $(=1,2,\ldots,m)$ indicates an overlapping test item. Since the discrimination parameter, a_g, is proportional to

TABLE 6-1

Three Sets of Overlapping Test Items between Adjacent Tests.

	Tests A5 & A6		Tests A6 & J1		Tests J1 & J2	
1	A533	A601	A641	J101	J137	J201
2	A534	A602	A642	J102	J138	J202
3	A535	A603	A643	J103	J139	J203
4	A536	A604	A644	J104	J140	J204
5	A537	A605	A645	J105	J141	J205
6	A538	A606	A646	J106	J142	J206
7	A539	A607	A647	J107	J143	J207
8	A540	A608	A648	J108	J144	J208
9	A541	A609	A649	J109	J145	J209
10	A542	A610	A650	J110	J146	J210
11	A543	A611	A651	J111	J147	J211
12	A544	A612	A652	J112	J148	J212
13	A545	A613	A653	J113	J149	J213
14	A546	A614	A654	J114	J150	J214
15	A547	A615	A655	J115	J151	J215
16	A548	A616	A656	J116	J152	J216
17					J153	J217
18					J154	J218
19					J155	J219
20					J156	J220

the slope of the item characteristic function at $\theta = b_g$ both in the normal ogive and in the logistic models, without considering the error of estimation we can write

$$(6.1) \qquad a_{g2} = (\sigma_2/\sigma_1)\, a_{g1} \quad ,$$

where σ_1 and σ_2 represent the standard deviations of the ability distributions of the examinee groups 1 and 2, respectively. Thus the second principal component of the two variables degenerates, and the first principal component provides us with the linear relationship between $\{a_{g1}\}$ and $\{a_{g2}\}$. With fallible data, however, this is not the case. It is well known that the first and second principal components of two random variables are their linear combinations which provide us with the maximum and minimum variances, respectively, with the constraint that the total variance stay the same. Thus we can take the first, dominating principal component as the best fitted linear relationship between $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$.

Let A be the $(2x2)$ symmetric matrix of the cross-products of $\hat{a}_{g1}$ and $\hat{a}_{g2}$. Thus we can write

$$(6.2) \qquad A = \{\sum_{g=1}^{m} \hat{a}_{gi}\, \hat{a}_{gj}\} \qquad i,j = 1,2 \quad .$$

It is well known that the two eigenvalues, λ_1 and λ_2, of the matrix A equal the variances of the first and second principal components of $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$, respectively. Let y be the

random vector of the two principal components, y_1 and y_2, of $\hat{a}_1 = \{\hat{a}_{g1}\}$ and $\hat{a}_2 = \{\hat{a}_{g2}\}$ $(g=1,2,\ldots,m)$. Thus we have

$$(6.3) \qquad y' = \{y_1, y_2\} \quad ,$$

with

$$(6.4) \qquad \text{Var.}\ (y_t) = \lambda_t \qquad\qquad t = 1,2 \quad ,$$

and

$$(6.5) \qquad y = \Gamma' \hat{a} \ ,$$

where Γ is the (2x2) matrix whose columns are the two eigenvectors corresponding to the two eigenvalues, λ_1 and λ_2, respectively, and $\hat{a}_g$ is the random vector of order 2 such that

$$(6.6) \qquad \hat{a}' = (\hat{a}_1, \hat{a}_2) \quad .$$

It is well known that, when Γ is a (2x2) matrix, we can write

$$(6.7) \qquad \Gamma = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} \quad ,$$

where α is the angle of the rotated axis specified by the first principal component with the axis representing a_1. Thus we have

$$(6.8)\qquad \begin{cases} y_1 = \hat{a}_1 \cos \alpha + \hat{a}_2 \sin \alpha \\ y_2 = -\hat{a}_1 \sin \alpha + \hat{a}_2 \cos \alpha \end{cases} .$$

Let u_1 be the eigenvector corresponding to the eigenvalue λ_1. We can write, therefore,

$$(6.9)\qquad u_1' = (u_{11}\ ,\ u_{12}) = (\cos \alpha,\ \sin \alpha) .$$

The estimate of the two standard deviations is given by

$$(6.10)\qquad \hat{\sigma}_2/\hat{\sigma}_1 = \tan \alpha = u_{12}/u_{11} .$$

Thus all we need is to compute the cross-products of $\hat{a}_{g1}$ and $\hat{a}_{g2}$ and produce the matrix A, to find out the eigenvector u_1 corresponding to its first, dominating eigenvalue, λ_1, of the matrix A, and take the ratio of the first element of the eigenvector u_1 to its second element.

We notice, however, in the above method that equal weights are put upon the error in $\hat{a}_1$ and upon the error in $\hat{a}_2$, which is not justifiable in the present situation, since the values of $\hat{a}_{g1}$ and $\hat{a}_{g2}$ are not determined on the same ability scale. To be more specific, if the unit of the scale is larger, then the values of the estimated discrimination parameters and their errors will also become larger, and vice versa. In minimizing the sum of the squared discrepancies from the first, dominating principal component, y_1,

therefore, the set of $\hat{a}_{gi}$ which is based upon the larger scale unit is more heavily penalized.

To ameliorate this situation, let us consider the following logic. Suppose that the ratio, σ_2/σ_1, is known, and we define the weight w in such a way that

$$(6.11) \qquad w = \sigma_1/\sigma_2 ,$$

and we further define

$$(6.12) \qquad a^*_{gi} \begin{cases} = a_{g1} & i=1 \\ = wa_{g2} & i=2 \end{cases} .$$

It is noted that, unlike a_{g1} *and* a_{g2}, a^*_{g1} *and* a^*_{g2} are comparable. We further define the (2x2) matrix A^* such that

$$(6.13) \qquad A^* = \{\sum_{g=1}^{m} a^*_{g1}a^*_{g2}\} = \begin{bmatrix} \sum_{g=1}^{m} a^2_{g1} & w\sum_{g=1}^{m} a_{g1}a_{g2} \\ w\sum_{g=1}^{m} a_{g1}a_{g2} & w^2\sum_{g=1}^{m} a^2_{g2} \end{bmatrix}$$

It is easy to see that the matrix A^* can be obtained directly from the matrix A, which is given by (6.2), by multiplying both its second row and second column by w. The two principal components, y^*_1 and y^*_2, of $a^*_1 = \{a^*_{g1}\}$ and $a^*_2 = \{a^*_{g2}\}$ $(g=1,2,\ldots,m)$ are given by

$$(6.14) \qquad \begin{cases} y_1^* = a_1^* \cos \alpha^* + a_2^* \sin \alpha^* \\ y_2^* = -a_1^* \sin \alpha^* + a_2^* \cos \alpha^* \end{cases} ,$$

where $\cos \alpha^*$ and $\sin \alpha^*$ are obtained as the two elements of the eigenvector, $u_1^* = (u_{11}^*, u_{12}^*)$, corresponding to the first, dominating eigenvalue, λ_1^*, of the matrix A^*. Thus we can write

$$(6.15) \qquad u_1^{*\prime} = (u_{11}^*, u_{12}^*) = (\cos \alpha^*, \sin \alpha^*) ,$$

and

$$(6.16) \qquad \tan \alpha^* = u_{12}^*/u_{11}^* .$$

From this result, we obtain

$$(6.17) \qquad \tan \alpha = (\tan \alpha^*)/w = (u_{12}^*/u_{11}^*)\ (\sigma_2/\sigma_1) .$$

Since, in practice, (σ_2/σ_1) is not known, the estimated ratio $(\hat{\sigma}_2/\hat{\sigma}_1)$ obtained by (6.10) can be used as its initial estimate, and the cycle of formulae (6.11) through (6.17) can be repeated, until (u_{12}^*/u_{11}^*) converges to unity.

The situation is somewhat different if we use the sets of estimated difficulty parameters of the overlapping items for the equating purposes. Let $\{b_{g1}\}$ and $\{b_{g2}\}$ $(g=1,2,\ldots,m)$ be the two sets of estimated item difficulty parameters of the m

overlapping test items obtained upon the examinee groups 1 and 2, respectively. Since the difficulty parameter b_g is the point of θ at which the conditional probability for answering the item correctly is 0.5 , without considering the error of estimation we can write

$$(6.18) \qquad b_{g2} = (\sigma_1/\sigma_2)\, b_{g1} + (\mu_1-\mu_2)/\sigma_2 \quad ,$$

where μ_1 and μ_2 are the means of the two ability distributions of the examinee groups 1 and 2, respectively. Thus unlike the case of the item discrimination parameter the best fitted line for the scatter diagram of the estimated difficulty parameters does not include the origin, unless $\mu_1 = \mu_2$. For this reason, it will be appropriate to shift the origins of b_{g1} and b_{g2} to their respective means, and follow the same process from there. Thus we must use the covariance matrix B such that

$$(6.19) \qquad B = \{ \sum_{g=1}^{m} [b_{gi} - \frac{1}{m} \sum_{h=1}^{m} \hat{b}_{hi}][\hat{b}_{gj} - \frac{1}{m} \sum_{h=1}^{m} \hat{b}_{hj}] \} \qquad i,j = 1,2 \quad ,$$

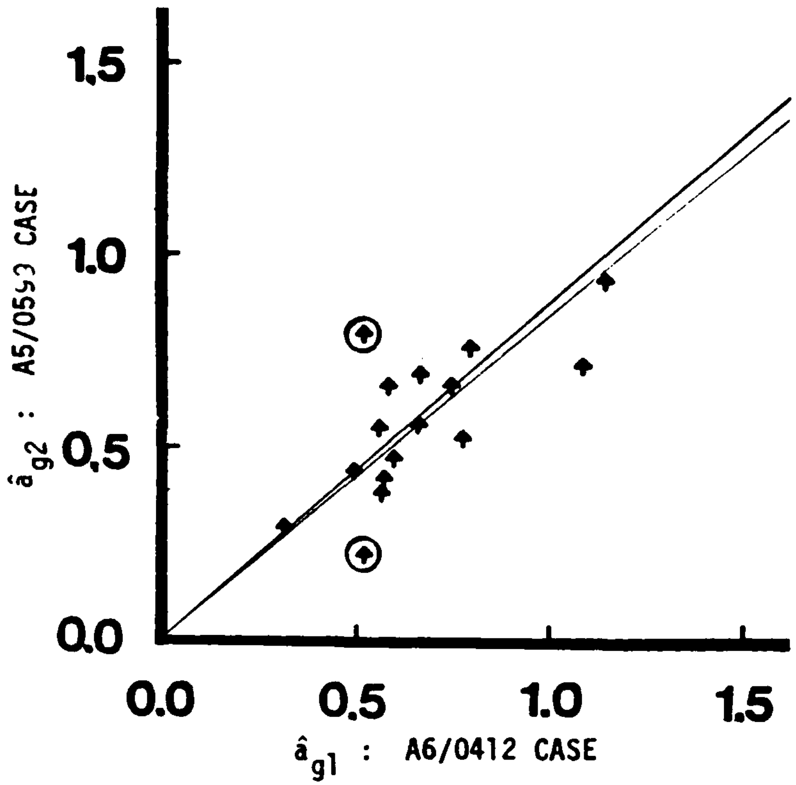
instead of the matrix of cross-products as we did for the scatter diagrams of estimated item discrimination parameters. Following the same iterative procedure by defining the matrix B* and using it in place of A* , which is obtained by multiplying the second row and the second column of the matrix B by the weight v such that

(6.20) $\quad v = \sigma_2/\sigma_1 = \tan\ \alpha$,

we obtain the estimate of $\cot\ \alpha$ which equals the ratio, (σ_1/σ_2) . Note that this ratio is given as the slope of the fitted linear relationship between $\{b_{g1}\}$ and $\{b_{g2}\}$, as is obvious from (6.18).

It is indicated in (6.18) that the intercept of the fitted linear relationship between $\{b_{g1}\}$ and $\{b_{g2}\}$ can be used as the estimated distance of μ_1 from μ_2 measured with σ_2 as the unit. If we wish to obtain the estimate of the distance of μ_2 from μ_1 with σ_1 as the unit of measurement, then we can simply multiply this intercept by (-1) , and then divide the result by the slope of the fitted line.

Figure 6-1 presents the three scatter diagrams of $\{\hat{a}_{g1}\}$ and $\{\hat{a}_{g2}\}$ for the overlapping test items in the A5/0599 and A6/0412 Cases, in the A6/0412 and J1/0614 Cases, and in the J1/0614 and J2/0758 Cases, together with the three similar scatter diagrams between J1/0614 and J1/1075 Cases, between J1/0614 and J1/2259 Cases, and between J1/1075 and J1/2259 Cases, respectively. Note that in the last three pairs of cases all the 55 items of Test J1 are treated as the overlapping items. In each of these six graphs, the best fitted line obtained by the iterative method described earlier in this section is shown by a thin, solid line. In the process of fitting these lines, however, those dots circled in the graphs were excluded, in order to hold some consistency with the corresponding estimation



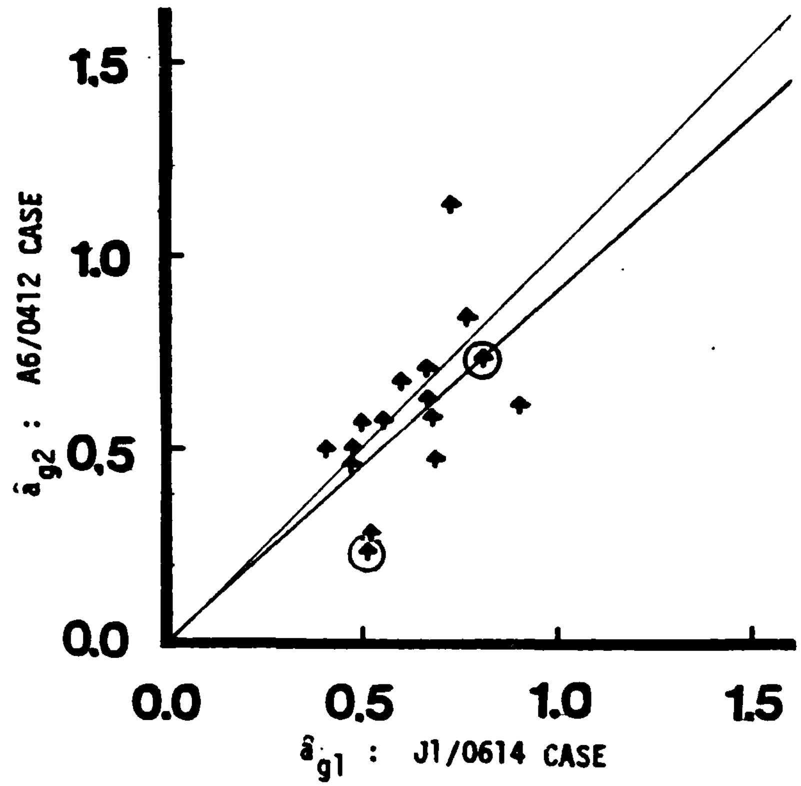
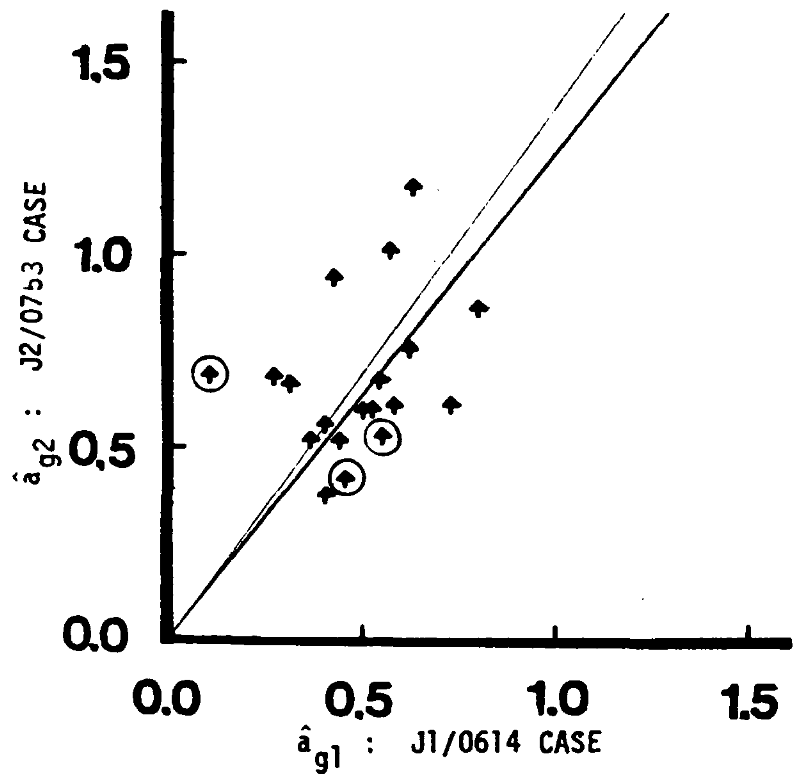


FIGURE 6-1

Two Sets of Estimated Item Discrimination Parameters of the Items Commonly Included by Two Adjacent Tests Which Were Obtained by the Tetrachoric Method. Fitted Linear Relationships Based upon Those Two Sets of Points (Thin Line) and upon Those and the Corresponding Two Sets of Estimated Difficulty Parameters (Thick Line) Are Also Shown. Circled Points Are Not Included in Line Fitting. *The Graph on the Left Hand Side Shows 16 Common Items in Tests A5 and A6,* Based upon the A5/0599 Case (a_{g2}) and A6/0412 Case (a_{g1}), Respectively, and the Graph on the Right Hand Side Shows 16 Common Items in Tests A6 and J1 Based upon the A6/0412 Case (a_{g2}) and J1/0614 Case (a_{g1}), Respectively.



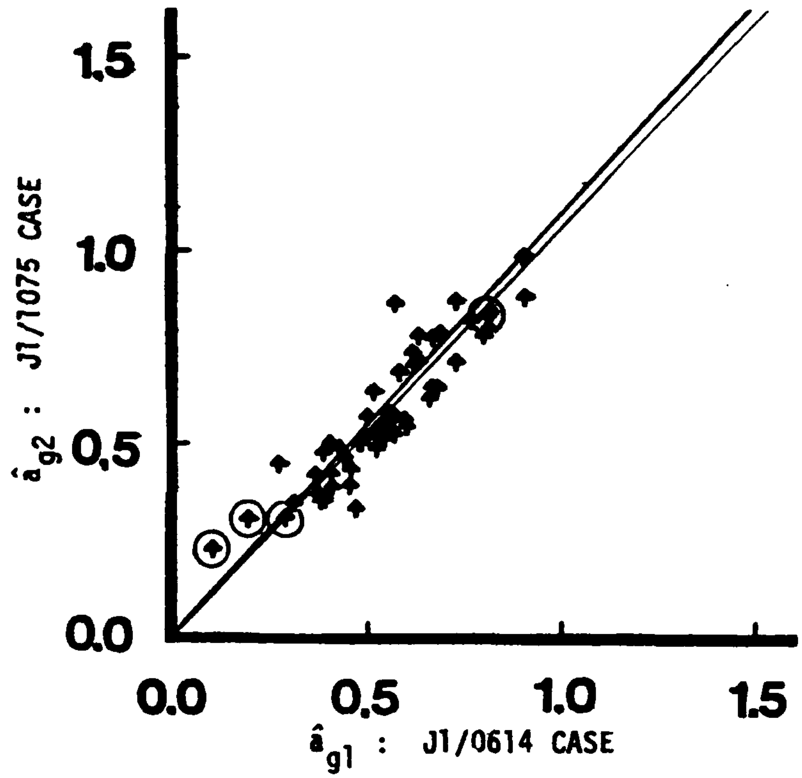
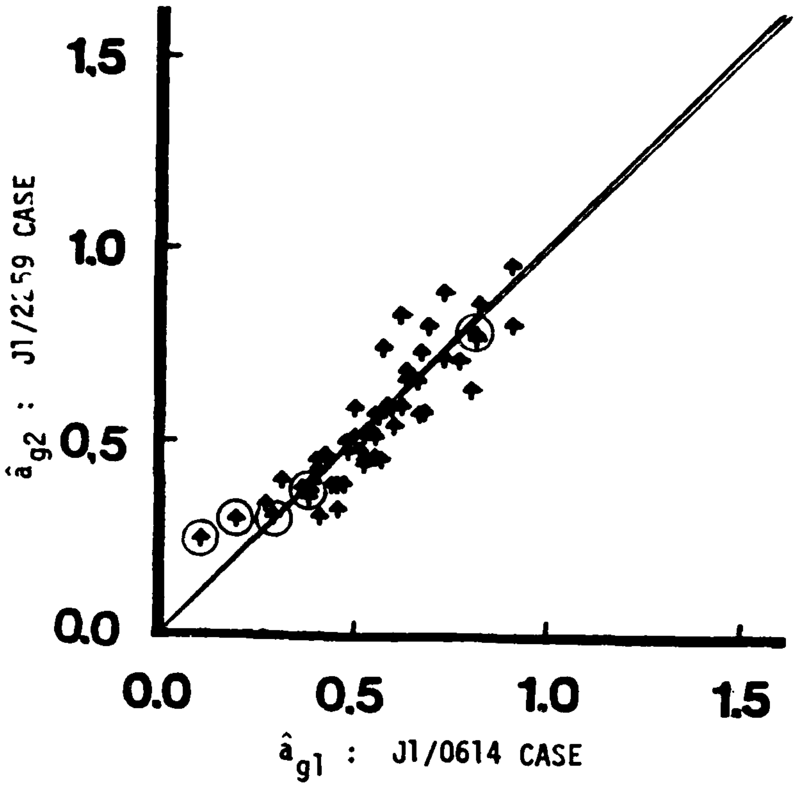


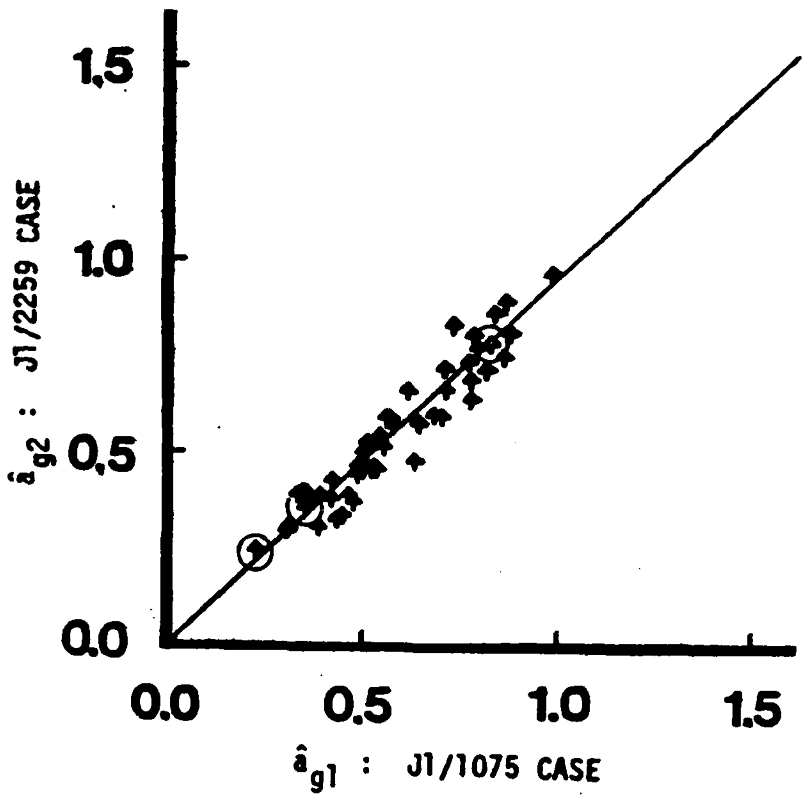
FIGURE 6-1 (Continued)

19 Common Items in Tests J1 and J2 Based upon the J1/0614 Case (a_{g1}) and J2/0758 Case (a_{g2}), Respectively.

55 Common Items in Test J1 Based upon the J1/0614 Case (a_{g1}) and J1/1075 Case (a_{g2}), Respectively.



55 Common Items in Test J1 Based upon the J1/0614 Case (a_{g1}) and J1/2259 Case (a_{g2}), Respectively.



55 Common Items in Test J1 Based upon the J1/1075 Case (a_{g1}) and J1/2259 Case (a_{g2}), Respectively.

FIGURE 6-1 (Continued)

based upon the scatter diagrams of the estimated difficulty parameters. The criterion for this exclusion will be explained in the subsequent paragraph. The slope and intercepts of each of these six fitted linear relationships between the two sets of estimated discrimination parameters are shown in the third and fourth columns of Table 6-2, respectively. We can see that the estimated intercept is close to zero in each case, the result which was expected from theory.

Figure 6-2 presents the corresponding six scatter diagrams of $\{b_{g1}\}$ and $\{b_{g2}\}$. Again in each graph the best fitted line is drawn by a thin, solid line. It is observed in these graphs that some of the estimated difficulty parameters are largely deviated from the rest. Since it is intrinsic in the Tetrachoric Method that those deviated values include large errors, all the dots having, at least, one estimated difficulty parameter outside the range of $[-2.0, 2.0]$ were excluded in the process of fitting the linear relationship. Those excluded dots are circled in Figure 6-2. The same items were also excluded in the process of fitting the line for the scatter diagrams of the estimated item discrimination parameters, and these are represented by the encircled dots in Figure 6-1. The slope and intercept of each of the six fitted relationships between the two sets of estimated difficulty parameters are shown in the sixth and seventh columns of Table 6-2, respectively.

Since, for each pair, we obtained two estimates of the ratio of the standard deviations of the ability distributions of the two examinee groups, the geometric mean of the two estimates was computed,

TABLE 6-2

Slope And Intercept of Each of the Fitted Linear Relationships between the Two Sets of Estimated Item Parameters a_g or b_g of the Common Test Items Based upon the Examinee Groups 1 and 2.

Examinee Group 1	Examinee Group 2	a_g		Combined	b_g		Combined	
		Slope	Intercept	Slope	Slope	Intercept	Slope	Intercept
A6/0412	A5/0599	0.834	0.004	0.868	1.106	0.606	1.152	0.634
J1/0614	A6/0412	1.014	-0.016	0.901	1.250	0.581	1.110	0.486
J1/0614	J2/0758	1.376	-0.001	1.254	0.875	-1.213	0.797	-1.171
J1/0614	J1/1075	1.055	-0.002	1.089	0.889	-0.272	0.918	-0.263
J1/0614	J1/2259	1.000	-0.004	1.009	0.983	-0.294	0.992	-0.292
J1/1075	J1/2259	0.948	-0.002	0.945	1.061	-0.036	1.058	-0.038

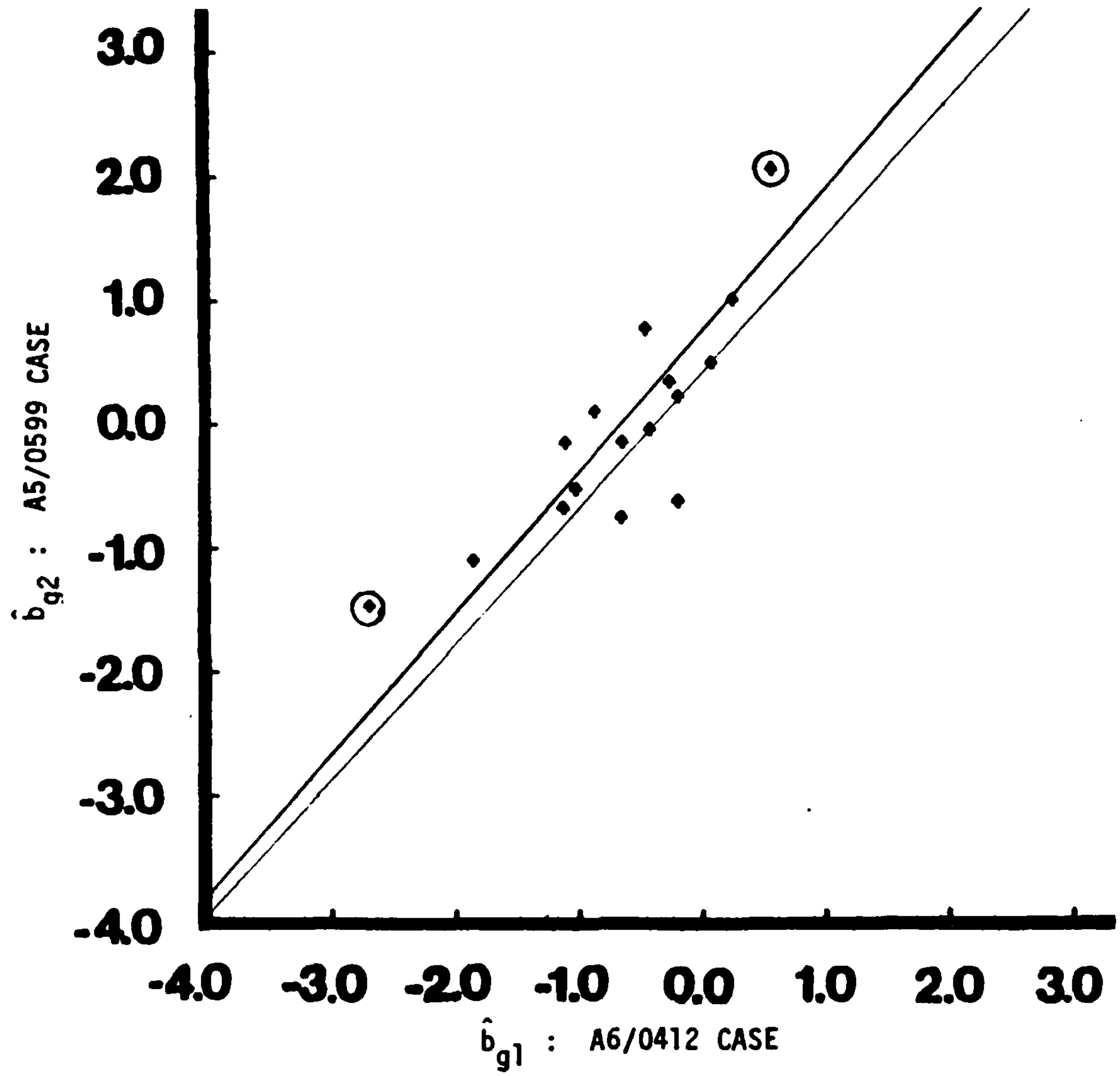


FIGURE 6-2

Two Sets of Estimated Item Difficulty Parameters of the Items Commonly Included by Two Adjacent Tests Which Were Obtained by the Tetrachoric Method. Fitted Linear Relationships Based upon Those Two Sets of Points (Thin Line) and upon Those and the Corresponding Two Sets of Estimated Discrimination Parameters (Thick Line) Are Also Shown. Circled Points Are Not Included in Line Fitting. 16 Common Items in Tests A5 and A6, Based upon the A5/0599 Case (b_{g2}) and A6/0412 Case (b_{g1}), Respectively.

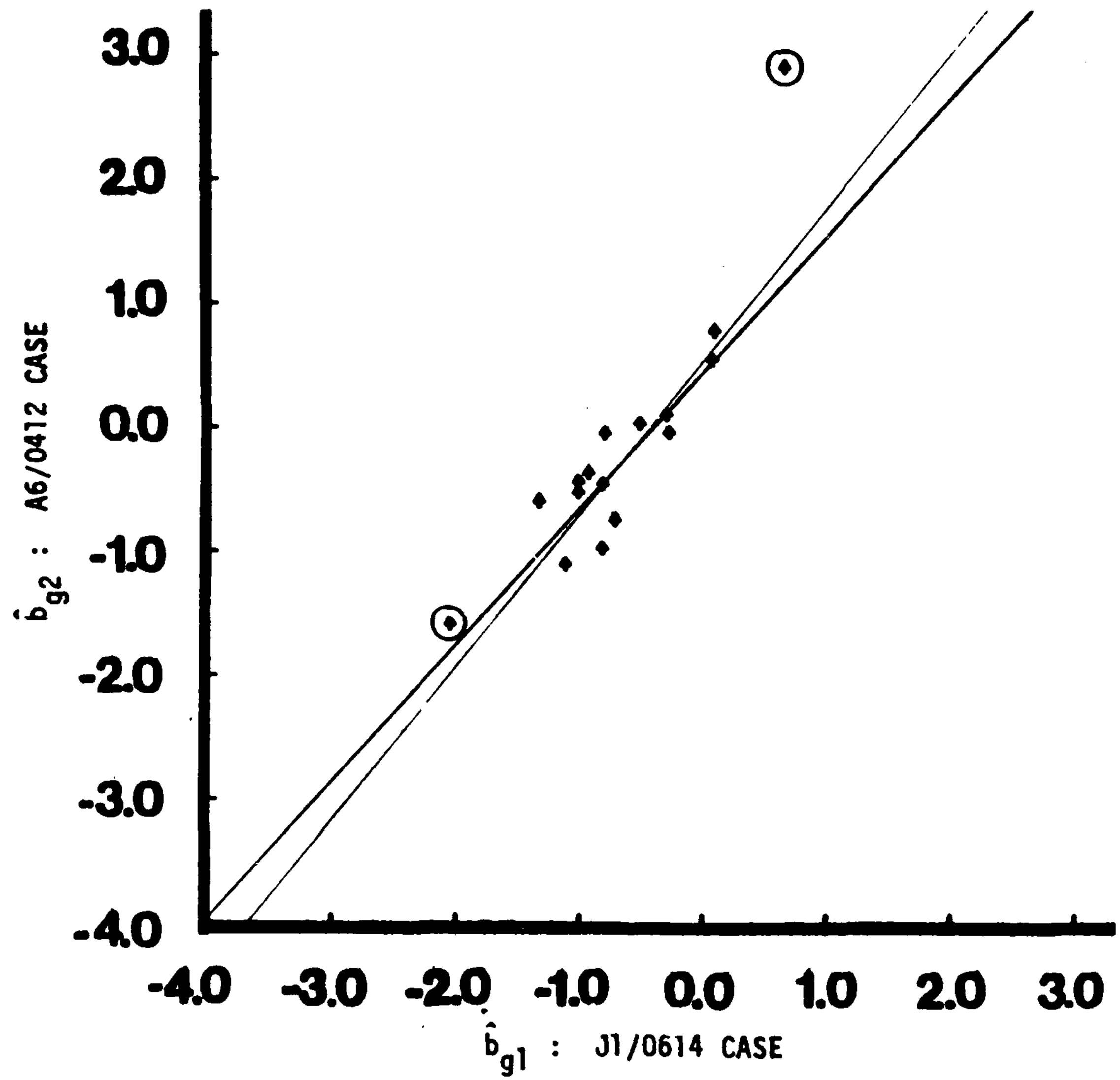


FIGURE 6-2 (Continued)

16 Common Items in Tests A6 and J1 Based upon the A6/0412 Case (b_{g2}) and J1/0614 Case (b_{g1}), Respectively.

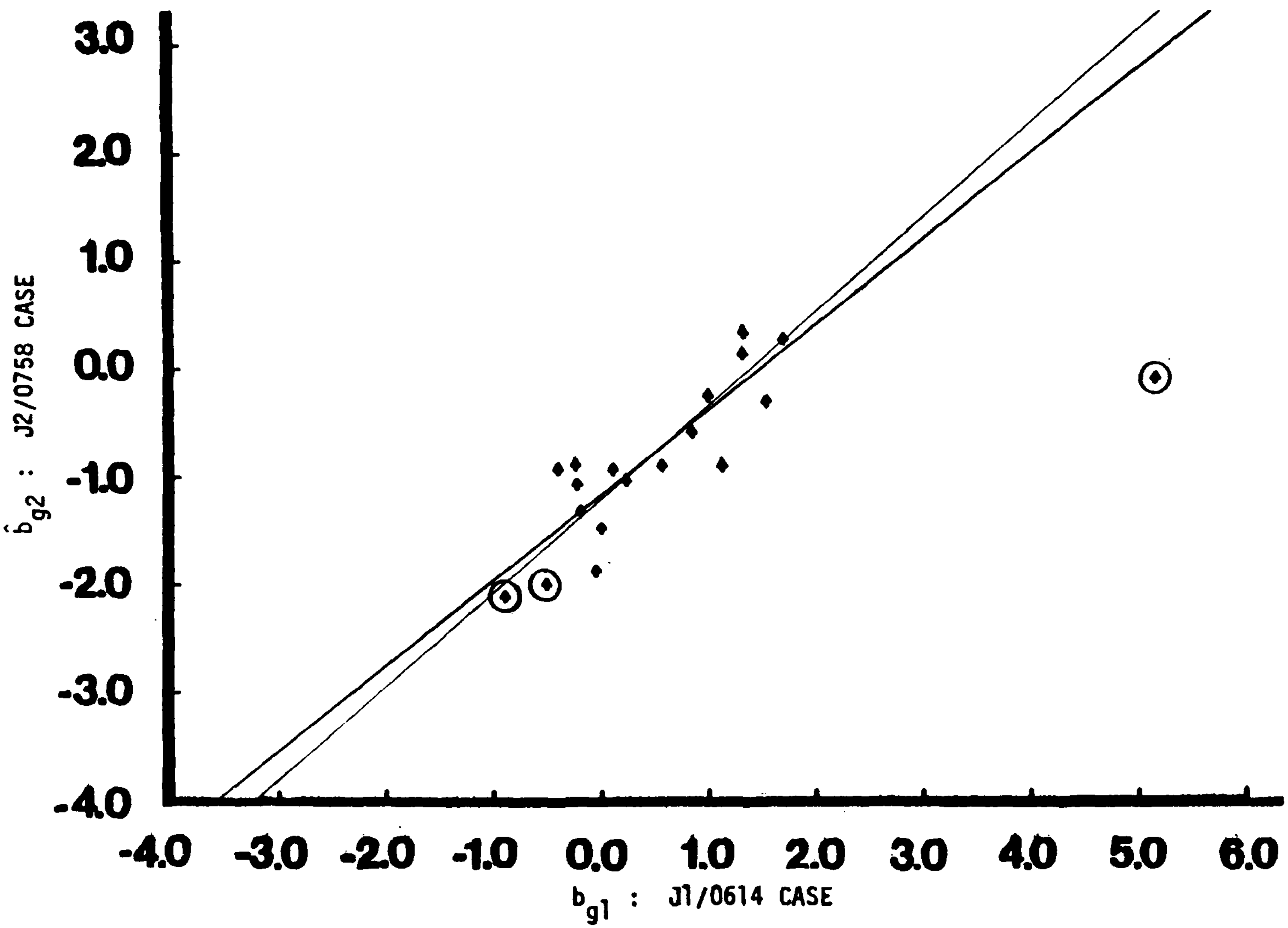


FIGURE 6-2 (Continued)

19 Common Items in Tests J1 and J2 Based upon the J1/0614 Case (b_{g1}) and J2/0758 Case (b_{g2}), Respectively.

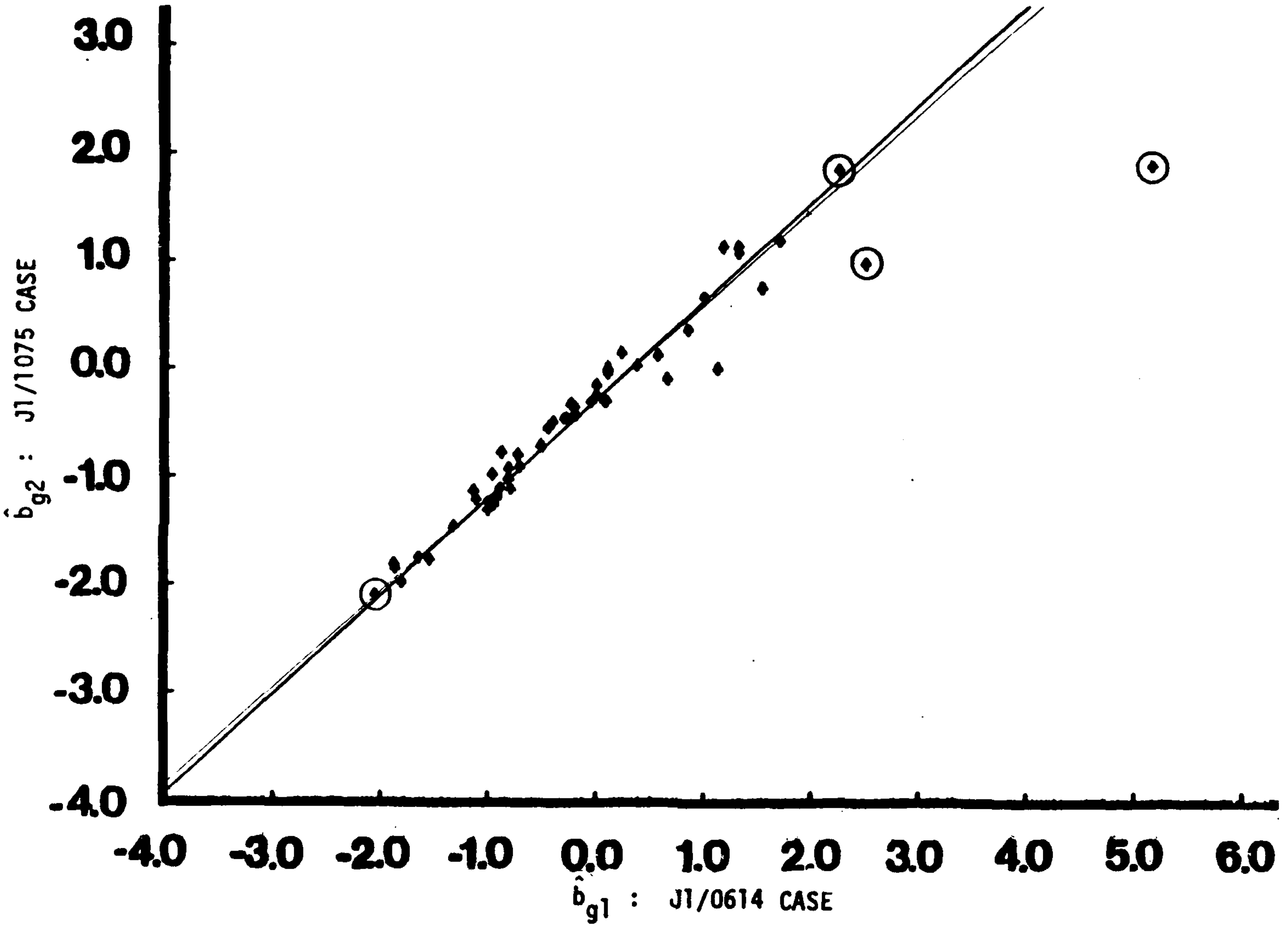


FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case (b_{g1}) and J1/1075 Case (b_{g2}), Respectively.

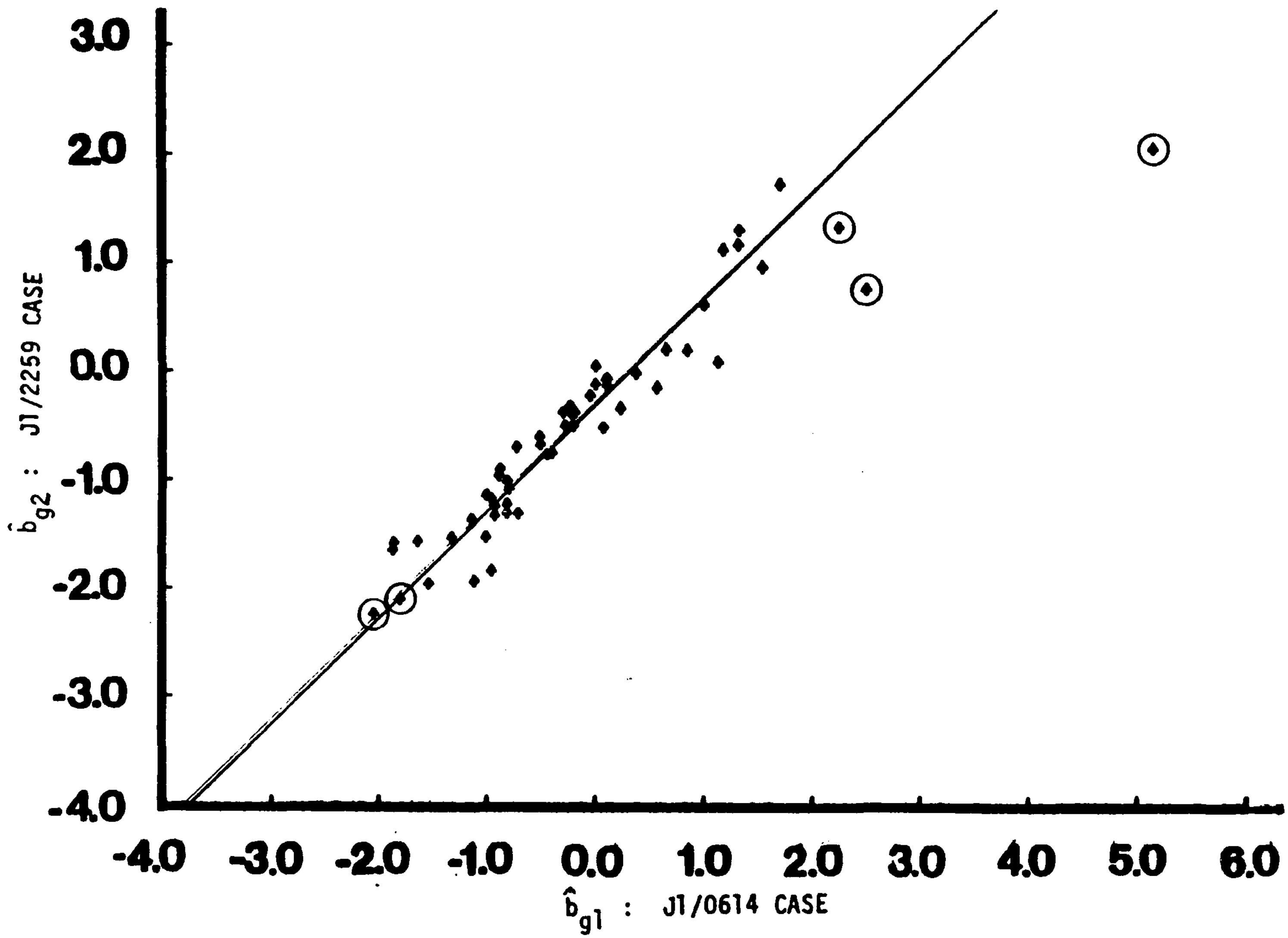


FIGURE 6-2 (Continued)

55 Common Items in Test J1 Based upon the J1/0614 Case (b_{g1}) and J1/2259 Case (b_{g2}), Respectively.

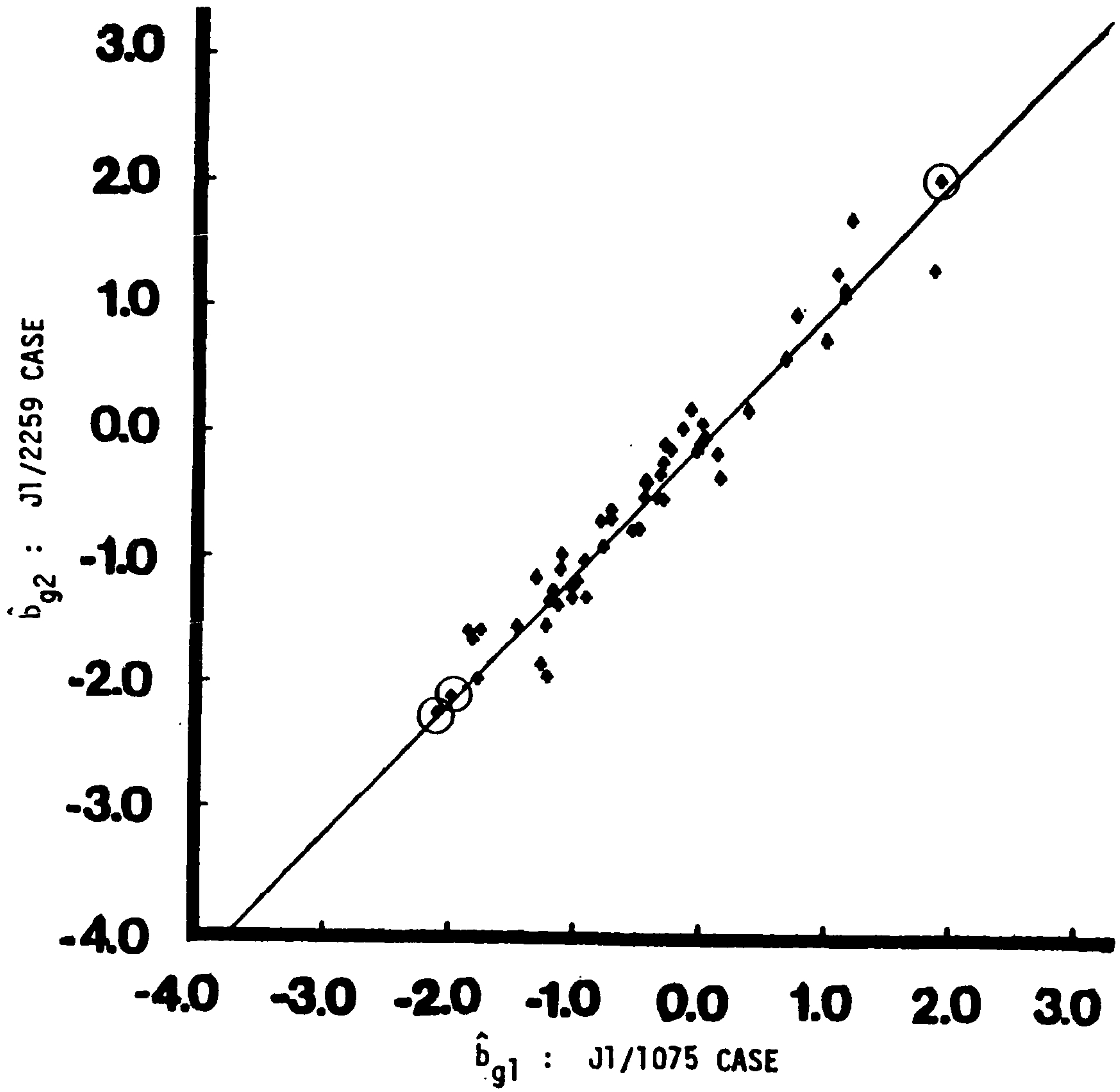


FIGURE 6-2 (Continued)

55 Common Items in Test Ji Based upon the J1/1075 Case (b_{g1}) and J1/2259 Case (b_{g2}), Respectively.

and used as the ultimate estimate of the ratio. The resulting linear function is shown by a thick, solid line in each graph of Figures 6-1 and 6-2. Note that, in Figure 6-2, not only the slope of the line is different from the one for the dotted line, but its intercept was also changed accordingly. Table 6-2 presents the slope thus obtained for each pair of sets of estimated discrimination parameters in its fifth column, and the slope and intercept of each of the six combined linear relationships for the estimated difficulty parameters in the eigth and ninth columns. Main intermediate results in the process of obtaining these values are shown in Appendix as Table A-1.

In order to put all the six ability distributions on a single ability scale, the following procedure was taken. First, we must pick up one examinee group who has taken a specific test, and decide to use the mean and standard deviation of its ability distribution as the origin and unit of the single ability scale. Let us call this specific examinee group as Subject Set 1. We can write

$$(6.21)\qquad \frac{\mu_k-\mu_1}{\sigma_1} = \sum_{u=1}^{k-1}\left[\frac{\mu_{u+1}-\mu_u}{\sigma_u}\prod_{s=1}^{u}\frac{\sigma_s}{\sigma_{s-1}}\right]$$

with $\sigma_0 \equiv 1$, and

$$(6.22)\qquad \sigma_k/\sigma_1 = \prod_{s=1}^{k-1}(\sigma_{s+1}/\sigma_s)$$

for Subject Set k (>1) . (6.21) and (6.22) indicate that the indirect comparisons of the mean and standard deviation of any examinee group with those of Subject Set 1 are possible through $(k-2)$ other examinee groups. For example, if we choose J2/0758 Case as Subject Set 1, $k = 4$ for the A5/0599 Case, since this examinee group can indirectly be compared with Subject Set 1 through two more examinee groups, i.e., A6/0412 and J1/0614 Cases. Since both the estimate of the ratio of the standard deviations of the ability distributions of two examinee groups, who took two adjacent tests, and the estimate of the distance between their means measured by the standard deviation of either one of the two examinee groups are available, (6.21) and (6.22) will provide us with the estimated mean and standard deviation of the ability distribution of every examinee group which are based upon the single ability scale with its origin and unit set equal to the mean and standard deviation of the ability distribution of Subject Set 1.

In the present study, our choice of Subject Set 1 is J1/0614 Case. Table 6-3 presents in its first six rows the estimates of the mean and the standard deviation of the ability distribution thus obtained for each of the six examinee groups. In these five cases other than J1/0614, $k = 3$ in the A5/0599 Case, and $k = 2$ otherwise. Since J1/1075 and J2/2259 Cases are directly compared using this result and $k = 3$, we obtained another set of estimates of the mean and the standard deviation for each case. These results are shown in the seventh and eighth rows of Table 6-3. We can see that they are reasonably close to the corresponding results obtained by the direct

TABLE 6-3

Estimated Mean and Standard Deviation of Each of the Six Ability Distributions on the Ability Scale, Which Uses the Mean and the Standard Deviation of the J1/0614 Case As Its Origin and Unit, Respectively, and Those of Each of the Three Ability Distributions of the Combined Examinee Groups. Those Estimates Obtained Indirectly for the J1/1075 and J1/2259 Cases Are Also Shown.

Examinee Group	Mean	S.D.
A5/0599	-0.93350538739880 00	0.78216826067880 00
A6/0412	-0.43774945038560 00	0.90070080478420 00
J1/0614	0.00000000000000 00	0.10000000000000 01
J2/0758	0.14688858318930 01	0.12539373469120 01
J1/1075	0.28650596555820 00	0.10891665269970 01
J1/2259	0.29456296083770 00	0.10085439035760 01
J1/1075(2259)	0.25663818688550 00	0.10668892453530 01
J1/2259(1075)	0.32522263133440 00	0.10296028998000 01
A5-A6	-0.73147626173170 00	0.86742029780830 00
J1-J2	0.77545519560830 00	0.12980715124140 01
A5-A6-J1-J2	0.23976331678590 00	0.13688532961810 01

comparisons with the J1/0614 Case, or with $k = 2$.

Since in using Logist 5 we produced three combined examinee groups, i.e., the combinations of A5/0599 and A6/0412 Cases, of the J1/1075 and J2/0758 Cases and of the A5/0599, A6/0412, J1/1075 and J2/0758 Cases, it is necessary to estimate the mean and the standard deviation of the ability distribution of each of these three combined examinee groups. We can write for the density function $f(\theta)$, the mean $E(\theta)$ and the variance $\text{Var.}(\theta)$ of any combined distribution

$$(6.23) \qquad f(\theta) = \sum_{i=1}^{M} p_i f_i(\theta) \quad ,$$

$$(6.24) \qquad E(\theta) = \sum_{i=1}^{M} p_i \int_{-\infty}^{\infty} f_i(\theta)\, d\theta = \sum_{i=1}^{n} p_i E_i(\theta)$$

and

$$(6.25) \qquad \text{Var.}(\theta) = \sum_{i=1}^{M} p_i \int_{-\infty}^{\infty} \theta^2 f_i(\theta) d\theta - [E(\theta)]^2 \quad ,$$

$$= \sum_{i=1}^{M} p_i \, \text{Var.}_i(\theta) + \sum_{i=1}^{M} p_i \, [E_i(\theta)]^2 - [E(\theta)]^2 \quad ,$$

where M is the number of original distributions involved, p_i is the probability assigned to the original population i , $f_i(\theta)$ is the density function for population i , and $E_i(\theta)$ and $\text{Var.}_i(\theta)$ are the mean and the variance of the ability distribution of the

population i , respectively. Using the estimated mean and standard deviation of the ability distribution of each examinee group involved and the proportion of the examinees of such a group i to those of the combined group as the estimate of p_i , we can obtain the estimated mean and standard deviation of each combined examinee group Through (6.24) and (6.25). These results are also shown in the last three rows of Table 6-3. The estimated ability distribution of each of the original and the combined examinee groups is also presented in Figure 6-3.

Tables 6-4 through 6-9 present the estimated item discrimination and difficulty parameters of each item of Tests A5, A6, J1 and J2, which were obtained by the Tetrachoric Method used for the A5/0599, A6/0412, J1/0614 and J2/0758 Cases, and then readjusted to this single ability scale, together with the two additional sets of estimated item parameters of the 55 items of Test J1 obtained upon the J1/1075 and J1/2259 Cases. In these tables, all the estimated item discrimination parameters and difficulty parameters which are less than 0.100 and exceed 3.000 in absolute value, respectively, are marked with ● .

VII. Item Parameters Estimated by Logist 5

As was mentioned in Section 3, in using Logist 5 we combined two or more examinee groups, who took different tests having some overlapping items, in order to provide us with the larger samples of examinees in the effort of increasing the accuracy of estimation. There are three such cases, and they are described in Table 3-2 of Section 3. For brevity, hereafter we shall call them Case A5-A6, Case J1-J2 and Case A5-A6-J1-J2, respectively, indicating the tests

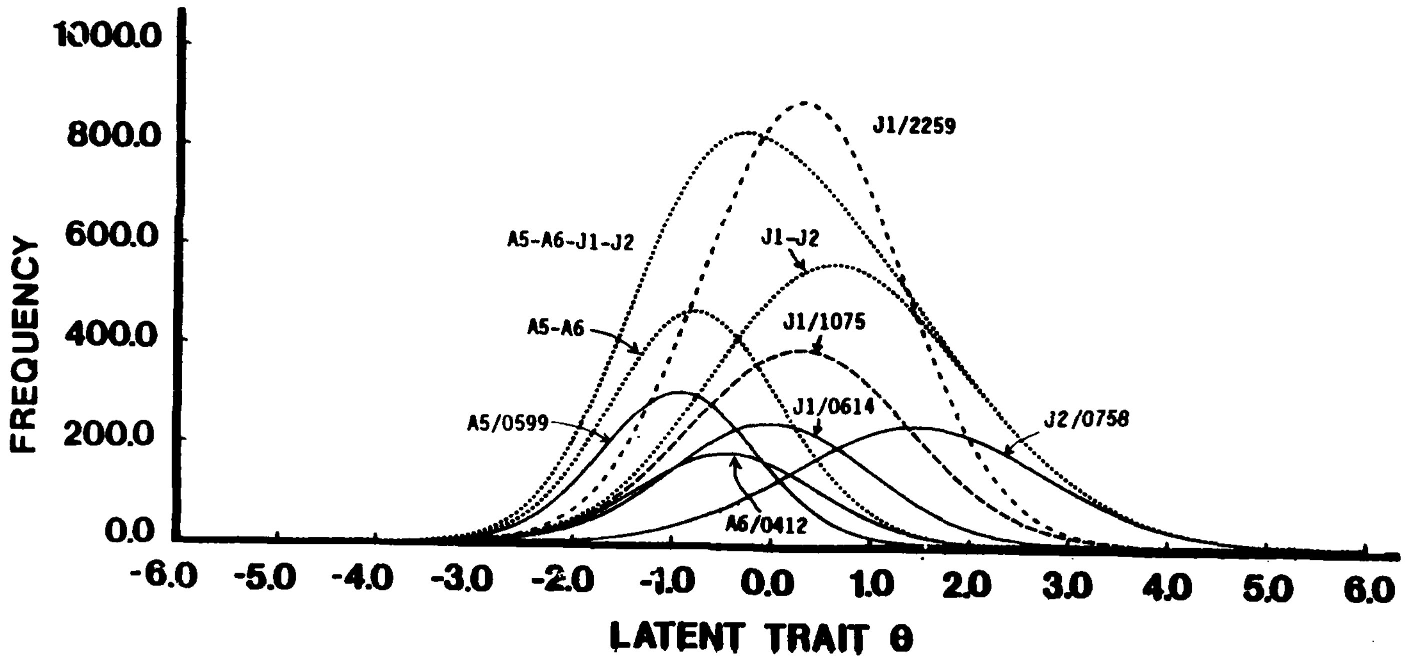


FIGURE 6-3

Estimated Ability Distributions (Solid Lines) of the A5/0599, A6/0412, J1/0614 And J2/0758 Cases, Those of the J1/1075 Case (Long Dashed Line) And of the J1/2259 Case (Short Dashed Line), Together with Those (Dotted Lines) of the Combined Examinee Groups, A5-A6 , J1-J2 And A5-A6-J1-J2.

TABLE 6-4

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Based upon the Tetrachoric Method Applied for the A5/0599 Case. After the Scale Adjustment Was Made.

Item	$\hat{a}_g$	$\hat{b}_g$
A501	0.822	-2.292
A502	0.597	-3.188 ●
A503	---	---
A504	0.730	-2.038
A505	0.849	-2.405
A506	0.559	-1.989
A507	0.542	-0.994
A508	0.873	-1.821
A509	1.356	-1.997
A510	0.758	-0.949
A511	0.589	-2.092
A512	0.759	-1.929
A513	---	---
A514	0.993	-1.864
A515	0.575	-2.249
A516	0.486	0.498
A517	---	---
A518	0.433	-2.494
A519	0.817	-1.936
A520	0.447	-2.995
A521	0.727	-1.931
A522	0.568	-0.702
A523	0.096 ●	4.836 ●
A524	0.501	-2.068
A525	1.036	-2.027
A526	0.993	-0.832
A527	0.097 ●	-0.210
A528	0.532	-0.140
A529	0.632	-0.598
A530	0.694	-1.770
A531	-0.064 ●	-21.642 ●
A532	0.610	-0.007
A533	0.877	-1.791
A534	1.011	-2.081
A535	0.665	-1.340
A536	0.839	-1.048
A537	0.598	-1.524
A538	1.189	-0.853
A539	0.841	-1.048
A540	0.483	-0.757
A541	0.699	-0.966
A542	0.557	-1.461
A543	0.710	-1.418
A544	0.965	-0.323
A545	0.906	-0.663
A546	0.279	0.684
A547	0.369	-0.539
A548	0.532	-0.140

TABLE 6-5

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Based upon the Tetrachoric Method Applied for the A6/0412 Case. After the Scale Adjustment Was Made.

Item	$\hat{a}_g$	$\hat{b}_g$
A601	0.737	-2.115
A602	0.574	-2.869
A603	0.862	-1.364
A604	0.645	-1.442
A605	0.662	-1.036
A606	1.269	-1.228
A607	0.827	-1.026
A608	0.626	-0.621
A609	0.620	-0.826
A610	0.546	-1.457
A611	0.733	-0.618
A612	0.882	-0.857
A613	1.205	-0.683
A614	0.576	0.070
A615	0.344	-0.377
A616	0.633	-0.220
A617	0.908	-1.719
A618	0.554	-1.265
A619	0.623	-1.266
A620	1.027	-0.623
A621	0.892	-1.013
A622	0.606	-1.810
A623	0.502	-1.553
A624	0.613	-2.264
A625	0.446	-1.885
A626	0.564	-1.093
A627	0.361	-0.525
A628	0.239	-3.050 ●
A629	0.695	-0.676
A630	0.701	-1.029
A631	0.656	-0.880
A632	0.663	-1.509
A633	0.425	-1.243
A634	1.025	-1.792
A635	0.785	-2.435
A636	0.705	-1.748
A637	0.527	-1.173
A638	0.467	0.770
A639	0.038 ●	19.949 ●
A640	0.623	-0.217
A641	0.697	0.070
A642	0.747	-1.309
A643	0.785	-0.906
A644	1.257	-0.474
A645	0.524	-0.332
A646	0.556	-0.840
A647	0.628	0.276
A648	0.814	-1.870
A649	0.508	-0.827
A650	0.643	-0.402
A651	0.678	-0.974
A652	0.312	-1.104
A653	0.635	-0.765
A654	0.258	2.190
A655	0.930	-0.466
A656	0.553	-1.428

TABLE 6-6

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/0614 Case. After the Scale Adjustment Was Made.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.668	0.072
J102	0.599	-0.817
J103	0.664	-1.013
J104	0.727	-0.799
J105	0.686	-0.301
J106	0.475	-0.815
J107	0.497	0.090
J108	0.809	-2.051
J109	0.470	-1.011
J110	0.678	-0.517
J111	0.901	-1.329
J112	0.521	-0.714
J113	0.553	-0.930
J114	0.513	0.657
J115	0.767	-0.279
J116	0.406	-1.117
J117	0.390	-0.880
J118	0.594	-0.959
J119	0.659	-0.926
J120	0.191	2.502
J121	0.482	-0.967
J122	0.524	-0.819
J123	0.552	0.103
J124	0.560	-1.863
J125	0.567	-1.541
J126	0.383	-0.727
J127	0.531	-1.643
J128	0.630	-1.144
J129	0.812	1.174
J130	0.379	-1.805
J131	0.905	-0.447
J132	0.454	0.000
J133	0.614	-1.873
J134	0.287	2.244
J135	0.819	-0.205
J136	0.371	0.374
J137	0.580	0.000
J138	---	---
J139	0.362	1.321
J140	0.403	0.107
J141	0.549	-0.894
J142	0.400	0.566
J143	0.620	-0.190
J144	0.452	-0.510
J145	0.798	-0.401
J146	0.727	-0.051
J147	0.267	1.125
J148	0.542	0.231
J149	0.499	-0.224
J150	0.524	-0.237
J151	0.424	0.999
J152	0.309	0.847
J153	0.438	1.696
J154	0.100	5.150
J155	0.569	1.536
J156	0.630	1.313

TABLE 6-7

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Based upon the Tetrachoric Method Applied for the J2/0758 Case. After the Scale Adjustment Was Made.

Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.484	-0.393
J202	---	---
J203	0.412	1.879
J204	0.298	0.289
J205	0.419	-1.197
J206	0.444	0.335
J207	0.601	-0.198
J208	0.331	-1.050
J209	0.685	0.295
J210	0.486	-0.892
J211	0.543	0.333
J212	0.535	0.164
J213	0.473	0.116
J214	0.475	0.342
J215	0.747	1.139
J216	0.528	0.719
J217	0.411	1.797
J218	0.546	1.336
J219	0.804	1.080
J220	0.936	1.633
J221	0.359	1.896
J222	0.575	0.654
J223	0.368	-0.476
J224	0.556	0.614
J225	0.549	-0.078
J226	0.549	0.650
J227	0.529	0.221
J228	0.532	-0.270
J229	0.521	0.092
J230	0.481	0.133
J231	0.953	-0.052
J232	0.710	-0.173
J233	0.282	2.146
J234	0.308	1.504
J235	0.775	0.678
J236	0.731	0.801
J237	0.226	-0.051
J238	0.707	2.358
J239	0.430	1.231
J240	0.552	1.777
J241	0.817	-0.003
J242	0.609	0.291
J243	0.328	0.480
J244	0.287	1.135
J245	0.691	1.316
J246	0.222	1.609
J247	0.431	1.206
J248	0.322	-0.741
J249	0.593	1.112
J250	0.572	0.995
J251	0.723	0.293
J252	0.471	1.395
J253	0.477	1.493
J254	0.489	1.421
J255	0.914	1.552
J256	0.464	2.067
J257	0.429	1.071
J258	0.362	1.621
J259	0.658	1.706
J260	0.073	3.692

TABLE 6-8

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/1075 Case. After the Scale Adjustment Was Made.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.708	-0.044
J102	0.497	-0.842
J103	0.590	-1.064
J104	0.650	-0.939
J105	0.719	-0.215
J106	0.459	-0.731
J107	0.521	-0.039
J108	0.759	-2.003
J109	0.303	-1.148
J110	0.588	-0.502
J111	0.902	-1.318
J112	0.446	-0.712
J113	0.508	-1.035
J114	0.580	0.182
J115	0.748	-0.211
J116	0.353	-1.044
J117	0.325	-0.569
J118	0.513	-1.100
J119	0.564	-1.001
J120	0.277	1.357
J121	0.458	-0.789
J122	0.491	-0.835
J123	0.484	0.237
J124	0.529	-1.738
J125	0.479	-1.648
J126	0.436	-0.590
J127	0.498	-1.627
J128	0.712	-0.957
J129	0.728	1.518
J130	0.322	-1.879
J131	0.805	-0.317
J132	0.396	0.017
J133	0.672	-1.693
J134	0.281	2.299
J135	0.768	-0.101
J136	0.337	0.316
J137	0.626	0.119
J138	---	---
J139	0.384	1.453
J140	0.386	0.273
J141	0.530	-0.928
J142	0.458	0.417
J143	0.644	-0.187
J144	0.357	-0.501
J145	0.713	-0.257
J146	0.794	-0.050
J147	0.410	0.287
J148	0.468	0.443
J149	0.472	-0.206
J150	0.473	-0.076
J151	0.446	1.012
J152	0.316	0.685
J153	0.425	1.579
J154	0.206	2.345
J155	0.790	1.097
J156	0.653	1.518

TABLE 6-9

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Based upon the Tetrachoric Method Applied for the J1/2259 Case. After the Scale Adjustment Was Made.

Item	$\hat{a}_g$	$\hat{b}_g$	Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.726	-0.238	J141	0.566	-0.689
J102	0.537	-0.956	J142	0.447	0.132
J103	0.568	-1.263	J143	0.586	-0.100
J104	0.710	-0.809	J144	0.384	-0.399
J105	0.794	-0.097	J145	0.630	-0.479
J106	0.495	-0.741	J146	0.880	0.057
J107	0.583	0.205	J147	0.333	0.374
J108	0.771	-1.974	J148	0.521	-0.062
J109	0.386	-0.872	J149	0.509	-0.108
J110	0.572	-0.327	J150	0.512	-0.040
J111	0.950	-1.266	J151	0.462	0.907
J112	0.437	-1.036	J152	0.394	0.478
J113	0.508	-1.061	J153	0.384	2.029
J114	0.472	0.486	J154	0.242	2.353
J115	0.704	-0.224	J155	0.738	1.258
J116	0.303	-1.671	J156	0.655	1.468
J117	0.390	-0.626			
J118	0.583	-1.573			
J119	0.653	-0.972			
J120	0.293	1.058			
J121	0.470	-0.904			
J122	0.451	-1.038			
J123	0.456	0.151			
J124	0.562	-1.313			
J125	0.450	-1.691			
J126	0.367	-0.424			
J127	0.525	-1.299			
J128	0.679	-1.094			
J129	0.761	1.416			
J130	0.351	-1.839			
J131	0.798	-0.494			
J132	0.322	0.162			
J133	0.822	-1.377			
J134	0.302	1.633			
J135	0.850	-0.225			
J136	0.368	0.264			
J137	0.591	0.331			
J138	---	---			
J139	0.375	1.602			
J140	0.422	0.216			

involved. The numbers of subjects in these three cases are 1,011, 1,833 and 2,844, respectively, as are shown in Table 3-2. In addition to these three cases, because of their larger sample sizes, J1/1075 and J1/2259 Cases were also analyzed alone, by assuming, separately, three-parameter logistic model as well as (two-parameter) logistic model. We shall call these four additional cases Case J1/1075: c_g-Zero, Case J1/1075: c_g-Free, Case J1/2259: c_g-Zero, and Case J1/2259: c_g-Free, respectively, depending upon whether the adopted model is two-parameter or three-parameter logistic model in each case.

Tables 7-1 and 7-2 present the estimated item discrimination parameter $\hat{a}_g$ and the estimated item difficulty parameters $\hat{b}_g$ of each item of Tests A5 and A6, respectively, which were obtained upon the Case A5-A6. In Logist 5, the resulting estimates of item parameters and individual parameters are adjusted to the scale of ability whose origin and unit are set equal to the mean and the standard deviation of the estimated individual parameters of the sample of subjects in question, excluding those which fall outside the interval, [-3, 3], after the last iteration. In Case A5-A6, one examinee was excluded because of his too low value of ability estimate, and seven examinees were excluded because of their too high values of ability estimate, to leave us 1,003 xaminees in this process of standardization. Since the percentage of those examinees who were excluded is only 0.79 and negligibly small, hereafter, we shall treat the distribution of θ for the 1,003 examinees as if it were of the whole group of examinees. The same applies for Cases

AD-A164 186 COMPARISON OF THE ESTIMATED ITEM PARAMETERS OF SHIBA'S WORD/PHASE COMPREH. (U) TENNESSEE UNIV KNOXVILLE F SAMEJIMA 13 DEC 85 RR-84-2 N00014-81-C-0569 2/4

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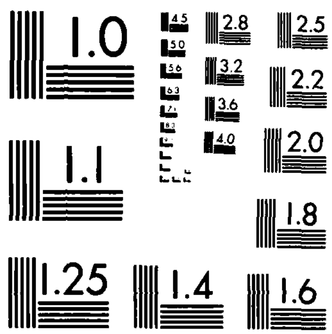

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TABLE 7-1

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A501	0.800	-1.717
A502	0.557	-2.729
A503	0.636	-2.873
A504	0.668	-1.462
A505	0.842	-1.809
A506	0.500	-1.444
A507	0.533	-0.306
A508	0.823	-1.238
A509	1.533	-1.352
A510	0.688	-0.293
A511	0.518	-1.575
A512	0.738	-1.321
A513	1.102	-2.196
A514	0.963	-1.268
A515	0.512	-1.700
A516	0.456	1.216
A517	1.896	-1.742
A518	0.400	-1.903
A519	0.753	-1.361
A520	0.391	-2.574
A521	0.687	-1.331
A522	0.436	0.020
A523	0.089 ▲	5.596 ▲
A524	0.469	-1.454
A525	1.075	-1.397
A526	0.944	-0.175
A527	0.094 ▲	0.290
A528	0.457	0.607
A529	0.574	0.108
A530	0.673	-1.134
A531	0.031 ▲	41.264 ▲
A532	0.548	0.747
A533	0.848	-1.208
A534	0.877	-1.568
A535	0.678	-0.694
A536	0.711	-0.484
A537	0.515	-0.723
A538	1.263	-0.313
A539	0.761	-0.371
A540	0.453	-0.016
A541	0.564	-0.237
A542	0.479	-0.829
A543	0.520	-0.477
A544	0.861	0.196
A545	0.953	0.017
A546	0.344	1.077
A547	0.307	0.297
A548	0.506	0.591

<u>Note</u>: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-2, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-2

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A601	0.848	-1.208
A602	0.877	-1.568
A603	0.678	-0.694
A604	0.711	-0.484
A605	0.515	-0.723
A606	1.263	-0.313
A607	0.761	-0.371
A608	0.453	-0.016
A609	0.564	-0.237
A610	0.479	-0.829
A611	0.520	-0.477
A612	0.861	0.196
A613	0.953	0.017
A614	0.344	1.077
A615	0.307	0.297
A616	0.506	0.591
A617	0.995	-0.923
A618	0.510	-0.532
A619	0.603	-0.517
A620	0.912	0.118
A621	0.881	-0.264
A622	0.628	-1.018
A623	0.459	-0.818
A624	0.608	-1.541
A625	0.408	-1.190
A626	0.522	-0.337
A627	0.337	0.276
A628	0.242	-2.154
A629	0.653	0.088
A630	0.636	-0.330
A631	0.593	-0.140
A632	0.645	-0.779
A633	0.399	-0.491
A634	1.183	-0.996
A635	0.946	-1.538
A636	0.718	-0.973
A637	0.483	-0.433
A638	0.455	1.587
A639	0.056 ▲	13.295 ▲
A640	0.536	0.600

Item	$\hat{a}_g$	$\hat{b}_g$
A641	0.628	0.907
A642	0.658	-0.618
A643	0.731	-0.162
A644	1.147	0.280
A645	0.487	0.481
A646	0.497	-0.070
A647	0.536	1.185
A648	0.873	-1.038
A649	0.440	-0.070
A650	0.546	0.390
A651	0.617	-0.263
A652	0.273	-0.381
A653	0.544	-0.043
A654	0.243	3.015 ▲
A655	0.857	0.301
A656	0.499	-0.736

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-1 respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

J1-J2 and A5-A6-J1-J2, as we shall see later in this section.

It is interesting to note that the two items, A531 and A639, whose estimated item parameters by the Tetrachoric Method assume the most extreme values as are shown in Tables 5-1 and 5-2, are also the two items who have the most extreme sets of estimated item parameters in Tables 7-1 and 7-2. For convenience, the estimated item discrimination parameters which is less than 0.100 and the estimated item difficulty parameters which exceed 3.000 are marked with ▲ in these tables, and also in Tables 7-3 through 7-9 and in Table 7-11, which will be presented later in this Section. These marks reveal a strong consistency in extreme parameter estimates between the results of the Tetrachoric Method and those of Logist 5 . We notice, moreover, that the whole configurations of the estimated discrimination parameters and of the estimated diffuculty parameters are very similar to those obtained by the Tetrachoric Method.

The corresponding results of Tests J1 and J2 obtained upon the Case J1-J2 are shown in Tables 7-3 and 7-4, respectively. In this case, those who were excluded in the process of standardization because of their too low and too high values of ability estimate number one and twelve, respectively, to make the number of remaining examinees 1,820. It is noted, again, that the percentage of those who were excluded is negligibly small, i.e., 0.71 .

We can see in these two tables that item J138 in Table 7-3 and item J202 in Table 7-4 are the only marked items, whose estimated discrimination parameters are less than 0.100 and whose estimated

TABLE 7-3

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.970	-0.617
J102	0.642	-1.215
J103	0.867	-1.316
J104	0.903	-1.266
J105	0.951	-0.752
J106	0.611	-1.111
J107	0.630	-0.617
J108	1.381	-1.862
J109	0.406	-1.387
J110	0.784	-0.956
J111	1.527	-1.482
J112	0.577	-1.119
J113	0.708	-1.322
J114	0.773	-0.442
J115	1.021	-0.748
J116	0.448	-1.372
J117	0.423	-0.979
J118	0.734	-1.354
J119	0.777	-1.311
J120	0.388	0.387
J121	0.619	-1.145
J122	0.648	-1.202
J123	0.609	-0.399
J124	0.820	-1.738
J125	0.677	-1.743
J126	0.580	-1.004
J127	0.748	-1.674
J128	1.063	-1.256
J129	0.843	0.685
J130	0.463	-1.839
J131	1.095	-0.827
J132	0.517	-0.554
J133	1.070	-1.724
J134	0.383	1.076
J135	1.025	-0.667
J136	0.415	-0.317
J137	0.796	-0.579
J138	0.010▲	145.324▲
J139	0.495	0.643
J140	0.417	-0.347

Item	$\hat{a}_g$	$\hat{b}_g$
J141	0.687	-1.267
J142	0.606	-0.292
J143	0.858	-0.728
J144	0.496	-1.016
J145	0.863	-0.679
J146	0.983	-0.721
J147	0.664	-0.382
J148	0.707	-0.352
J149	0.599	-0.672
J150	0.588	-0.553
J151	0.719	0.120
J152	0.553	-0.156
J153	0.536	0.696
J154	0.473	0.458
J155	1.103	0.209
J156	1.025	0.552

Note: The estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-4, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-4

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.796	-0.579	J241	1.300	-0.592
J202	0.010▲	145.324▲	J242	0.878	-0.389
J203	0.495	0.643	J243	0.428	-0.249
J204	0.417	-0.347	J244	0.315	0.146
J205	0.687	-1.267	J245	0.892	0.342
J206	0.606	-0.292	J246	0.285	0.611
J207	0.858	-0.728	J247	0.546	0.271
J208	0.496	-1.016	J248	0.435	-1.121
J209	0.863	-0.679	J249	0.747	0.182
J210	0.983	-0.721	J250	0.765	0.102
J211	0.664	-0.382	J251	1.046	-0.399
J212	0.707	-0.352	J252	0.561	0.430
J213	0.599	-0.672	J253	0.617	0.482
J214	0.588	-0.553	J254	0.615	0.445
J215	0.719	0.120	J255	1.179	0.505
J216	0.553	-0.156	J256	0.548	0.975
J217	0.536	0.696	J257	0.573	0.190
J218	0.473	0.458	J258	0.442	0.585
J219	1.103	0.209	J259	0.843	0.659
J220	1.025	0.552	J260	0.126	1.664
J221	0.466	0.805			
J222	0.764	-0.143			
J223	0.506	-0.922			
J224	0.747	-0.153			
J225	0.810	-0.617			
J226	0.727	-0.131			
J227	0.731	-0.442			
J228	0.791	-0.742			
J229	0.756	-0.493			
J230	0.665	-0.480			
J231	1.701	-0.592			
J232	1.089	-0.689			
J233	0.332	1.041			
J234	0.385	0.506			
J235	1.110	-0.127			
J236	1.012	-0.035			
J237	0.294	-0.634			
J238	0.858	1.215			
J239	0.550	0.278			
J240	0.673	0.732			

<u>Note</u>: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-3, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

difficulty parameters are greater than 3.000 . As we can see in the notes attached to these two tables, they are a single item overlapping in Test J1 and J2, and also it is the item which has been discarded by Shiba (cf. Tables 5-3 and 5-4). Again we notice that the whole configurations of the two estimated item parameters in Tables 7-3 and 7-4 are very similar to those obtained by the Tetrachoric Method, which are shown in Tables 5-3 and 5-4, respectively.

Tables 7-5 through 7-8 present the resulting item parameter estimates of each item of Tests A5, A6, J1 and J2, respectively, which were obtained upon the Case A5-A6-J1-J2. Again, some subjects were excluded in the process of standardization, and those who were excluded because of thier too low ability estimates and of their too high ones number one and thirteen, respectively. Thus we had 2,830 subjects in the standardization process of this case. The percentage of those examinees who were excluded is, again, negligibly small, i.e., 0.49 .

It is noted that, in general, the estimated discrimination parameters of the items of Tests A5 and A6 in Tables 7-5 and 7-6 are larger than the corresponding values shown in Tables 7-1 and 7-2, even in the extreme cases such as items A531, A639, A523 and A527. This is an expected result, for the distribution of the individual ability estimates in Case A5-A6-J1-J2 is likely to have a larger standard deviation than the one in Case A5-A6, and, therefore, the scale unit in Case A5-A6-J1-J2 is larger than that in Case A5-A6. The true comparison of these two sets of results will be possible after a

TABLE 7-5

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A501	1.017	-2.059
A502	0.708	-2.858
A503	0.808	-2.969
A504	0.852	-1.857
A505	1.077	-2.127
A506	0.636	-1.845
A507	0.679	-0.950
A508	1.049	-1.681
A509	1.951	-1.772
A510	0.877	-0.940
A511	0.659	-1.948
A512	0.939	-1.748
A513	1.404	-2.434
A514	1.226	-1.706
A515	0.651	-2.046
A516	0.580	0.246
A517	2.405	-2.080
A518	0.510	-2.205
A519	0.961	-1.777
A520	0.498	-2.733
A521	0.874	-1.755
A522	0.555	-0.694
A523	0.112	3.754 ▲
A524	0.596	-1.853
A525	1.371	-1.806
A526	1.200	-0.847
A527	0.122	-0.488
A528	0.580	-0.232
A529	0.730	-0.625
A530	0.853	-1.603
A531	0.036 ▲	34.662 ▲
A532	0.697	-0.123
A533	1.095	-1.649
A534	1.133	-1.927
A535	0.877	-1.250
A536	0.926	-1.087
A537	0.668	-1.273
A538	1.631	-0.955
A539	0.985	-1.001
A540	0.590	-0.728

Item	$\hat{a}_g$	$\hat{b}_g$
A541	0.737	-0.897
A542	0.624	-1.353
A543	0.679	-1.082
A544	1.117	-0.563
A545	1.236	-0.701
A546	0.446	0.114
A547	0.400	-0.489
A548	0.660	-0.263

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-6, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2.

TABLE 7-6

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A601	1.095	-1.649
A602	1.133	-1.927
A603	0.877	-1.250
A604	0.926	-1.087
A605	0.668	-1.273
A606	1.631	-0.955
A607	0.985	-1.001
A608	0.590	-0.728
A609	0.737	-0.897
A610	0.624	-1.353
A611	0.679	-1.082
A612	1.117	-0.563
A613	1.236	-0.701
A614	0.446	0.114
A615	0.400	-0.489
A616	0.660	-0.263
A617	1.330	-1.405
A618	0.672	-1.120
A619	0.808	-1.100
A620	1.236	-0.625
A621	1.161	-0.914
A622	0.833	-1.481
A623	0.610	-1.330
A624	0.811	-1.870
A625	0.544	-1.607
A626	0.697	-0.967
A627	0.452	-0.508
A628	0.323	-2.327
A629	0.860	-0.650
A630	0.854	-0.960
A631	0.792	-0.819
A632	0.862	-1.297
A633	0.533	-1.082
A634	1.568	-1.462
A635	1.264	-1.865
A636	0.955	-1.446
A637	0.644	-1.039
A638	0.611	0.468
A639	0.079▲	8.694▲
A640	0.709	-0.264
A641	1.032	-0.140
A642	0.659	-0.911
A643	0.968	-0.796
A644	1.199	-0.610
A645	0.910	-0.325
A646	0.659	-0.658
A647	0.754	-0.066
A648	1.346	-1.391
A649	0.495	-0.788
A650	0.842	-0.457
A651	1.343	-0.948
A652	0.541	-0.741
A653	0.790	-0.767
A654	0.753	0.132
A655	1.093	-0.336
A656	0.475	-1.055

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-5, respectively since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2. Also The estimated item parameters for items A641 through A656 are the same as those for J101 through J116 in Table 7-7, respectively, since they are overlapping items between Tests A6 and J1.

TABLE 7-7

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	1.032	-0.140
J102	0.659	-0.911
J103	0.968	-0.796
J104	1.199	-0.610
J105	0.910	-0.325
J106	0.659	-0.658
J107	0.754	-0.066
J108	1.346	-1.391
J109	0.495	-0.788
J110	0.842	-0.457
J111	1.343	-0.948
J112	0.541	-0.741
J113	0.790	-0.767
J114	0.753	0.132
J115	1.093	-0.336
J116	0.475	-1.055
J117	0.478	-0.472
J118	0.830	-0.804
J119	0.880	-0.764
J120	0.437	0.738
J121	0.701	-0.618
J122	0.731	-0.670
J123	0.692	0.041
J124	0.928	-1.143
J125	0.768	-1.146
J126	0.656	-0.494
J127	0.848	-1.085
J128	1.200	-0.718
J129	0.956	0.999
J130	0.522	-1.235
J131	1.237	-0.337
J132	0.584	-0.096
J133	1.204	-1.135
J134	0.433	1.344
J135	1.161	-0.196
J136	0.469	0.114
J137	0.902	-0.119
J138	0.010▲	145.711▲
J139	0.562	0.958
J140	0.472	0.085

Item	$\hat{a}_g$	$\hat{b}_g$
J141	0.779	-0.725
J142	0.687	0.134
J143	0.973	-0.250
J144	0.563	-0.504
J145	0.979	-0.206
J146	1.118	-0.242
J147	0.753	0.055
J148	0.802	0.082
J149	0.682	-0.200
J150	0.667	-0.096
J151	0.816	0.498
J152	0.628	0.255
J153	0.609	1.004
J154	0.536	0.795
J155	1.254	0.576
J156	1.167	0.877

Note: The estimated item parameters for items J101 through J116 are the same as those for items A641 through A656 in Table 7-6, respectively, since they are overlapping items between Tests A6 and J1 and the results are of Case A5-A6-J1-J2. Also the estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-8, respectively, since they are overlapping items between Tests J1 and J2.

TABLE 7-8

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 And J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.902	-0.119
J202	0.010▲	145.711▲
J203	0.562	0.958
J204	0.472	0.085
J205	0.779	-0.725
J206	0.687	0.134
J207	0.973	-0.250
J208	0.563	-0.504
J209	0.979	-0.206
J210	1.118	-0.242
J211	0.753	0.055
J212	0.802	0.082
J213	0.682	-0.200
J214	0.667	-0.096
J215	0.816	0.498
J216	0.628	0.255
J217	0.609	1.004
J218	0.536	0.795
J219	1.254	0.576
J220	1.167	0.877
J221	0.531	1.097
J222	0.870	0.265
J223	0.578	-0.418
J224	0.851	0.256
J225	0.925	-0.149
J226	0.831	0.276
J227	0.833	0.003
J228	0.902	-0.260
J229	0.863	-0.042
J230	0.757	-0.031
J231	1.938	-0.129
J232	1.242	-0.213
J233	0.380	1.303
J234	0.440	0.834
J235	1.268	0.279
J236	1.153	0.360
J237	0.336	-0.163
J238	0.977	1.457
J239	0.626	0.634
J240	0.767	1.033
J241	1.487	-0.128
J242	1.001	0.049
J243	0.487	0.171
J244	0.358	0.518
J245	1.016	0.690
J246	0.324	0.927
J247	0.623	0.629
J248	0.496	-0.593
J249	0.849	0.550
J250	0.872	0.480
J251	1.194	0.041
J252	0.640	0.767
J253	0.703	0.814
J254	0.702	0.781
J255	1.341	0.834
J256	0.624	1.246
J257	0.653	0.557
J258	0.504	0.904
J259	0.960	0.969
J260	0.142	1.863

<u>Note</u>: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-7, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case A5-A6-J1-J2.

suitable scale adjustment, which is to be done later. We also notice that there are more negative values in the estimated difficulty parameters in Tables 7-5 and 7-6 than in those in Tables 7-1 and 7-2. Again this is an expected result, for the mean of the distribution of the individual ability estimates in Case A5-A6-J1-J2 is likely to be higher than that in Case A5-A6, and, therefore, the origin of the scale in the former is shifted to the positive direction.

Comparison of the results in Tables 7-7 and 7-8 with those in Tables 7-3 and 7-4 reveals the same tendency for the estimated discrimination parameters of the items of Tests J1 and J2 as we observed for the items of Tests A5 and A6, and also the reversed tendency for the estimated difficulty parameters. Again they are no surprise, for the origin of the scale used for Case A5-A6-J1-J2 is expected to be shifted to the negative direction compared with that in Case J1-J2, and the unit is expected to be larger in the former case than in the latter.

The estimated item parameters of each item of Test J1 which were obtained upon the Cases J1/1075: c_g-Zero and J1/1075: c_g-Free are presented in Tables 7-9 and 7-10, respectively. Since in the latter three-parameter logistic model is assumed, there is an additional column of the estimated guessing parameter c_g in Table 7-10. The corresponding sets of results for Cases J1/2259: c_g-Zero and J1/2259: c_g-Free are shown in Tables 7-11 and 7-12, respectively. In these cases, item J138 is excluded, since it was discarded in Shiba's research and also it provided us with meaningless

TABLE 7-9

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.842	-0.309
J102	0.560	-0.994
J103	0.757	-1.110
J104	0.788	-1.052
J105	0.832	-0.463
J106	0.535	-0.873
J107	0.550	-0.307
J108	1.214	-1.729
J109	0.356	-1.184
J110	0.691	-0.693
J111	1.338	-1.298
J112	0.501	-0.886
J113	0.615	-1.120
J114	0.674	-0.107
J115	0.895	-0.458
J116	0.388	-1.178
J117	0.369	-0.723
J118	0.637	-1.157
J119	0.676	-1.105
J120	0.338	0.846
J121	0.543	-0.911
J122	0.566	-0.978
J123	0.531	-0.058
J124	0.717	-1.591
J125	0.594	-1.593
J126	0.507	-0.751
J127	0.652	-1.520
J128	0.930	-1.040
J129	0.734	1.188
J130	0.406	-1.702
J131	0.957	-0.549
J132	0.448	-0.236
J133	0.945	-1.567
J134	0.330	1.651
J135	0.898	-0.366
J136	0.362	0.037
J137	0.695	-0.173
J138	---	---
J139	0.456	0.945
J140	0.420	-0.012

Item	$\hat{a}_g$	$\hat{b}_g$
J141	0.645	-1.025
J142	0.506	0.106
J143	0.749	-0.430
J144	0.397	-0.693
J145	0.822	-0.504
J146	0.915	-0.325
J147	0.499	-0.013
J148	0.536	0.112
J149	0.538	-0.436
J150	0.532	-0.333
J151	0.493	0.611
J152	0.390	0.298
J153	0.503	1.092
J154	0.248	1.613
J155	0.921	0.695
J156	0.788	1.047

TABLE 7-10

Estimated Item Discrimination Parameter $\hat{a}_g$, Item Difficulty Parameter $\hat{b}_g$ And Guessing Parameter c_g of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$	Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J101	1.104	0.006	0.146	J141	0.667	-0.762	0.143
J102	0.588	-0.706	0.143	J142	1.024	0.687	0.245
J103	0.786	-0.872	0.143	J143	1.102	0.018	0.201
J104	0.854	-0.795	0.143	J144	0.451	-0.238	0.143
J105	1.034	-0.167	0.137	J145	0.903	-0.287	0.103
J106	0.599	-0.512	0.143	J146	1.053	-0.130	0.087
J107	0.678	0.054	0.143	J147	1.727	0.779	0.338
J108	1.012	-1.855	0.143	J148	0.895	0.613	0.207
J109	0.382	-0.726	0.143	J149	0.639	-0.063	0.143
J110	0.781	-0.382	0.143	J150	0.629	0.041	0.143
J111	1.286	-1.201	0.143	J151	0.889	0.980	0.181
J112	0.538	-0.541	0.143	J152	1.391	1.086	0.331
J113	0.634	-0.857	0.143	J153	1.250	1.212	0.167
J114	1.285	0.411	0.234	J154	0.764	1.895	0.249
J115	1.185	-0.100	0.173	J155	1.768	0.771	0.089
J116	0.421	-0.753	0.143	J156	1.592	1.030	0.086
J117	0.411	-0.245	0.143				
J118	0.640	-0.916	0.143				
J119	0.707	-0.851	0.143				
J120	1.205	1.310	0.278				
J121	0.584	-0.580	0.143				
J122	0.601	-0.665	0.143				
J123	0.697	0.311	0.143				
J124	0.679	-1.479	0.143				
J125	0.584	-1.415	0.143				
J126	0.568	-0.375	0.143				
J127	0.635	-1.364	0.143				
J128	0.964	-0.831	0.143				
J129	0.900	1.110	0.018				
J130	0.403	-1.402	0.143				
J131	1.327	-0.167	0.191				
J132	0.555	0.193	0.143				
J133	0.909	-1.471	0.143				
J134	0.702	1.715	0.162				
J135	0.922	-0.266	0.041				
J136	0.453	0.515	0.143				
J137	0.897	0.130	0.131				
J138	---	---	---				
J139	1.335	1.197	0.213				
J140	0.660	0.623	0.218				

TABLE 7-11

Estimated Item Discrimination Parameter $\hat{a}_g$ And Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.771	-0.509	J141	0.588	-0.945
J102	0.554	-1.192	J142	0.467	-0.157
J103	0.627	-1.428	J143	0.622	-0.379
J104	0.775	-1.034	J144	0.380	-0.685
J105	0.855	-0.377	J145	0.656	-0.752
J106	0.517	-0.972	J146	0.936	-0.243
J107	0.594	-0.083	J147	0.366	0.068
J108	0.987	-1.986	J148	0.525	-0.355
J109	0.389	-1.109	J149	0.505	-0.393
J110	0.596	-0.592	J150	0.542	-0.324
J111	1.165	-1.422	J151	0.474	0.558
J112	0.442	-1.283	J152	0.403	0.151
J113	0.532	-1.287	J153	0.436	1.525
J114	0.492	0.175	J154	0.257	1.822
J115	0.752	-0.502	J155	0.799	0.916
J116	0.305	-1.876	J156	0.744	1.077
J117	0.400	-0.861			
J118	0.665	-1.693			
J119	0.710	-1.189			
J120	0.296	0.715			
J121	0.506	-1.096			
J122	0.476	-1.245			
J123	0.465	-0.144			
J124	0.626	-1.465			
J125	0.493	-1.807			
J126	0.378	-0.664			
J127	0.579	-1.462			
J128	0.763	-1.285			
J129	0.763	1.130			
J130	0.392	-1.883			
J131	0.869	-0.753			
J132	0.335	-0.108			
J133	0.968	-1.526			
J134	0.301	1.275			
J135	0.925	-0.502			
J136	0.366	-0.015			
J137	0.611	0.025			
J138	---	---			
J139	0.401	1.179			
J140	0.419	-0.075			

TABLE 7-12

Estimated Item Discrimination Parameter $\hat{a}_g$, Item Difficulty Parameter $\hat{b}_g$ And Guessing Parameter c_g of Each of the 55 Items of Test J1 Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J101	0.957	-0.195	0.151
J102	0.576	-0.924	0.146
J103	0.644	-1.198	0.146
J104	0.849	-0.781	0.146
J105	1.034	-0.154	0.109
J106	0.570	-0.627	0.146
J107	0.733	0.170	0.109
J108	0.857	-2.097	0.146
J109	0.424	-0.682	0.146
J110	0.712	-0.240	0.146
J111	1.123	-1.342	0.146
J112	0.461	-0.946	0.146
J113	0.556	-0.998	0.146
J114	1.004	0.743	0.245
J115	0.955	-0.140	0.172
J116	0.324	-1.385	0.146
J117	0.444	-0.426	0.146
J118	0.635	-1.581	0.146
J119	0.749	-0.948	0.146
J120	0.571	1.361	0.229
J121	0.535	-0.777	0.146
J122	0.497	-0.923	0.146
J123	0.582	0.257	0.146
J124	0.625	-1.261	0.146
J125	0.491	-1.588	0.146
J126	0.433	-0.190	0.146
J127	0.580	-1.252	0.146
J128	0.772	-1.103	0.146
J129	0.884	1.063	0.013
J130	0.388	-1.597	0.146
J131	1.063	-0.418	0.178
J132	0.413	0.415	0.146
J133	0.968	-1.401	0.146
J134	0.460	1.620	0.146
J135	1.011	-0.342	0.085
J136	0.460	0.459	0.146
J137	0.769	0.269	0.108
J138	---	---	---
J139	1.005	1.355	0.193
J140	0.531	0.358	0.146
J141	0.628	-0.646	0.146
J142	0.854	0.557	0.267
J143	0.915	0.114	0.209
J144	0.426	-0.226	0.146
J145	0.727	-0.455	0.146
J146	1.154	-0.041	0.101
J147	1.571	1.025	0.373
J148	0.638	0.022	0.146
J149	0.600	-0.015	0.146
J150	0.660	0.043	0.146
J151	0.817	0.944	0.182
J152	1.026	0.949	0.308
J153	1.323	1.375	0.156
J154	0.677	1.945	0.212
J155	1.505	0.920	0.085
J156	1.589	1.043	0.095

item parameter estimates in Cases J1-J2 and A5-A6-J1-J2, as was observed earlier in this section.

Observation of Tables 7-9 and 7-11 reveals that the estimated item discrimination parameters obtained by Logist 5 in Cases J1/1075: c_g-Zero and J1/2259: c_g-Zero tend to be greater than their counterparts obtained by the Tetrachoric Method, which are shown in Tables 5-11 and 5-12, respectively, while the estimated item difficulty parameters by Logist 5 in these two cases tend to be larger in absolute value. This fact indicates that the standard deviation of the estimated individual parameters may be larger than that of θ itself for the J1/1075 and J1/2259 Cases.

Comparison of Table 7-10 with Table 7-9, and of Table 7-12 with Table 7-11, reveals that the estimated discrimination parameters when three-parameter logistic model is assumed are, in general, larger than those when (two-parameter) logistic model is assumed, and the same is true with the estimated difficulty parameters. This is especially true when the estimated guessing parameter assumes a large value in Cases J1/1075: c_g-Free and J1/2259: c_g-Free, as we can see in items J114, J120, J139, J140, J142, J143, J147, J148, J152 and J154 in Case J1/1075, and in items J114, J120, J142, J143, J147, J152 and J154 in Case J1/2259. It is also noted that, except for these items, all the other items have estimated guessing parameters which are less than the chance level, i.e., 0.2 .

Enhancement of both the estimated discrimination and the estimated difficulty parameters when three-parameter logistic model is

assumed appeared to have a good reason. This topic has been more systematically investigated, and discussed in a separate paper (Samejima, ONR/RR-84-3). As a conclusion, the meaning of discrimination and difficulty parameters must seriously be reconsidered in the three-parameter logistic model.

Figure 7-1 presents five scatter diagrams, in which the estimated item discrimination parameters of the items of Test A5, A6, J1 or J2 obtained by Logist 5 in Case A5-A6 or in Case J1-J2 are plotted against those obtained by the Tetrachoric Method. In the third graph, the diagram consists of only sixteen items which overlap Tests A6 and J1, while in the other four it consists of all the items in each of the four tests except for those whose estimates are extremely deviated. The corresponding five graphs for the estimated difficulty parameters are shown in Figure 7-2. We can see in these two figures that there is a substantial consistency in the estimated item parameters obtained by Logist 5 based upon two examinee groups, i.e., Case A5-A6 or Case J1-J2, and those obtained by the Tetrachoric Method.

Figures 7-3 and 7-4 present similar graphs as those of Figures 7-1 and 7-2 excluding the third graph of sixteen items, using the results of Case A5-A6-J1-J2 instead of those of Case A5-A6 or Case J1-J2. We can see that, again, there exists a substantial consistency in each pair of estimated item parameters.

Figures 7-5 shows eight scatter diagrams of the estimated item discrimination parameters of Test J1. They consist of four pairs, in

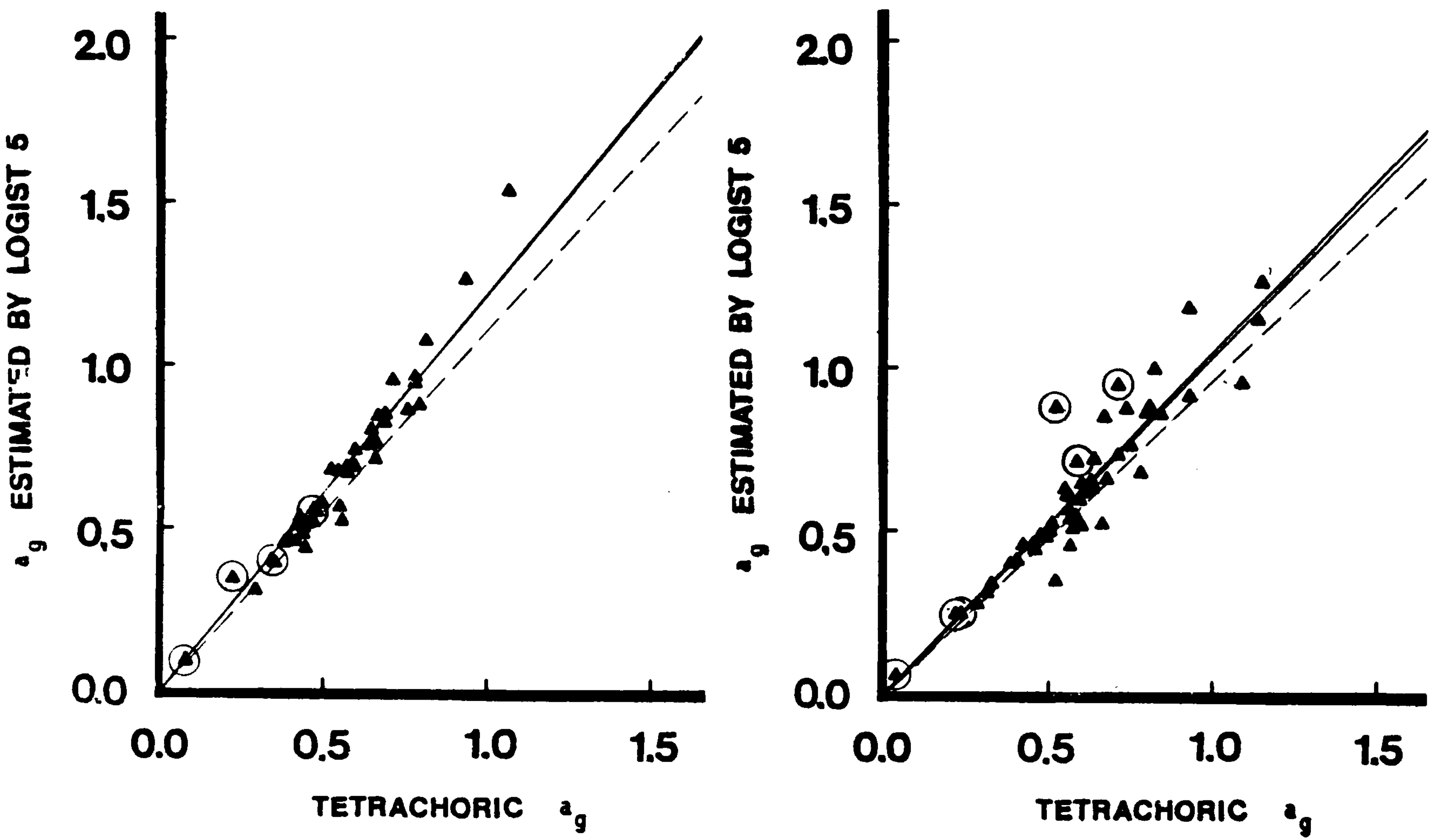


FIGURE 7-1

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa and upon the Case A5-A6 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

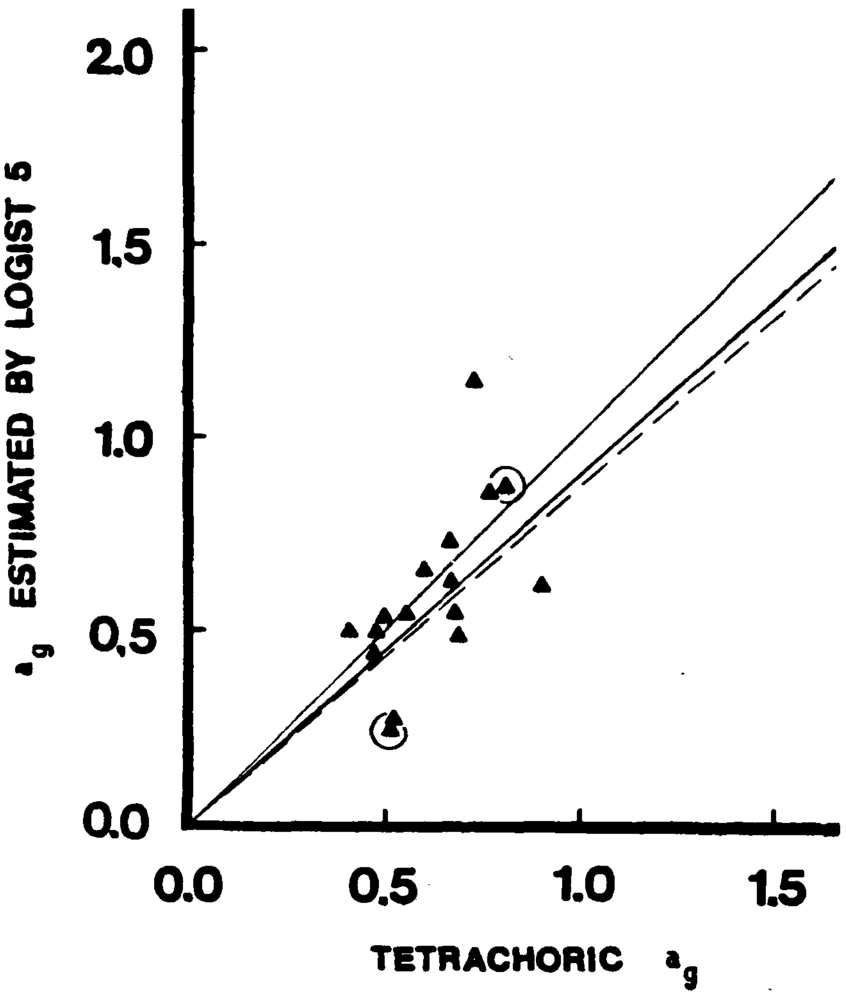


FIGURE 7-1 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

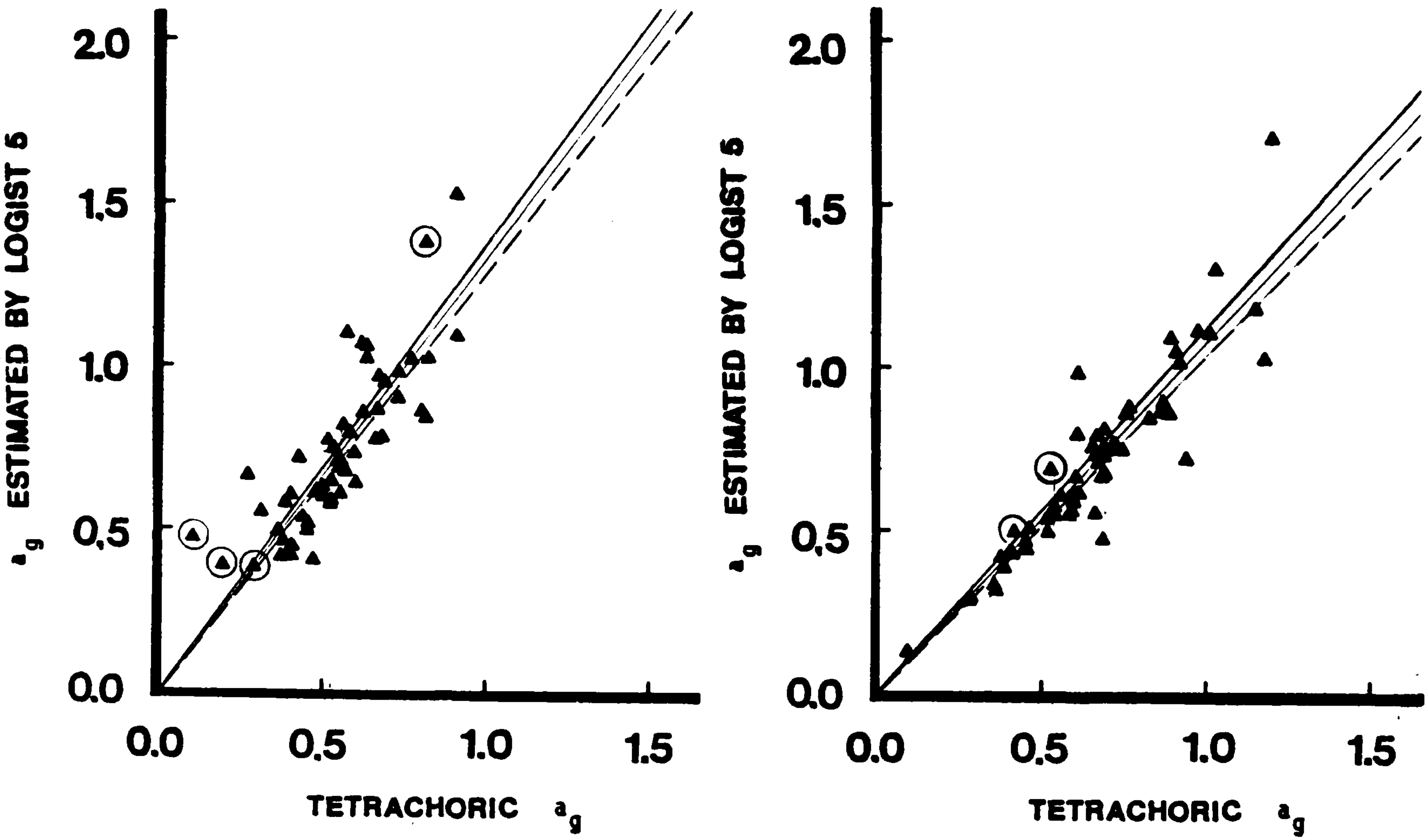


FIGURE 7-1 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

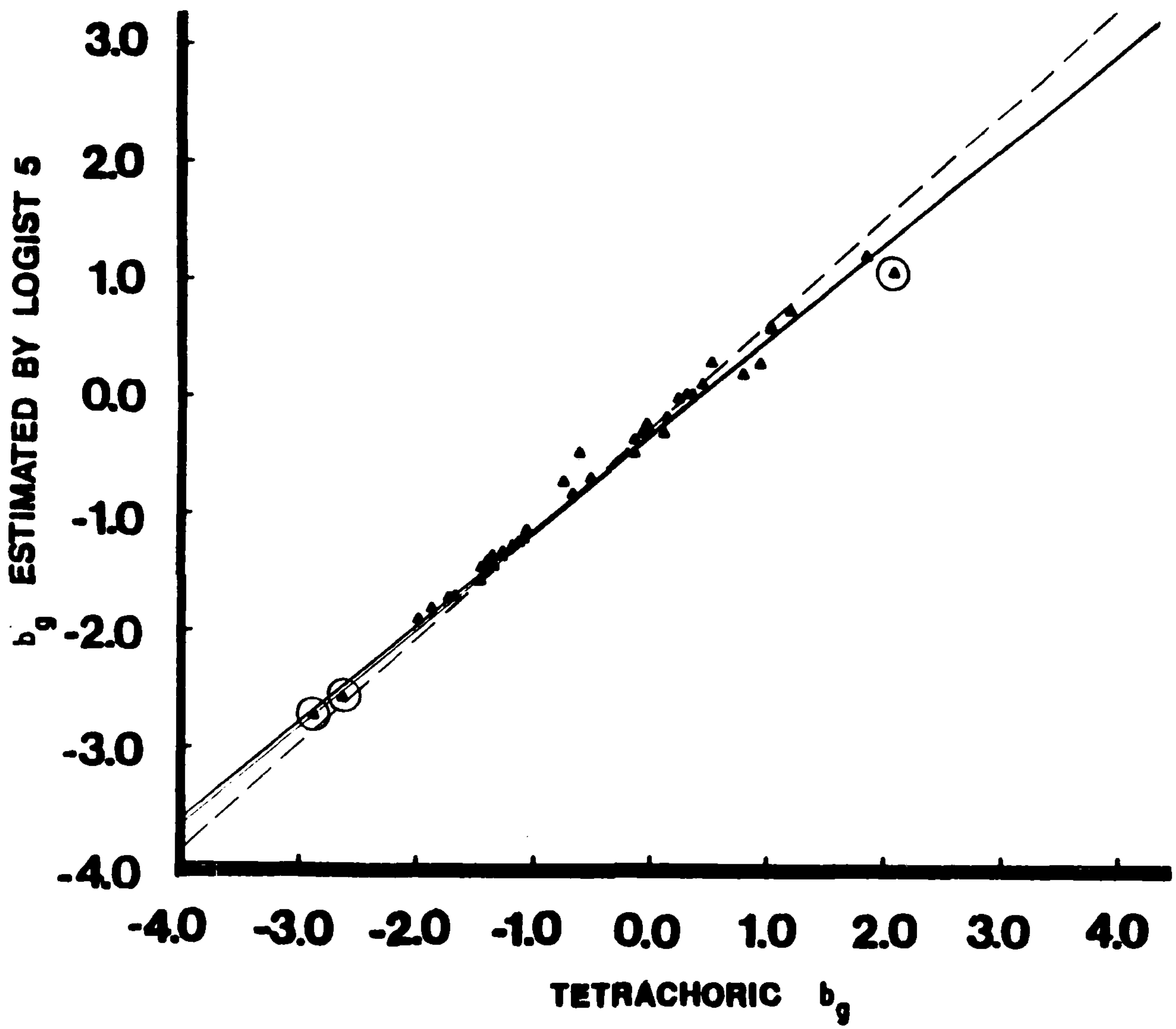


FIGURE 7-2

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Solid, Thin Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. For the 43 Items of Test A5 Excluding Items A523 and A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

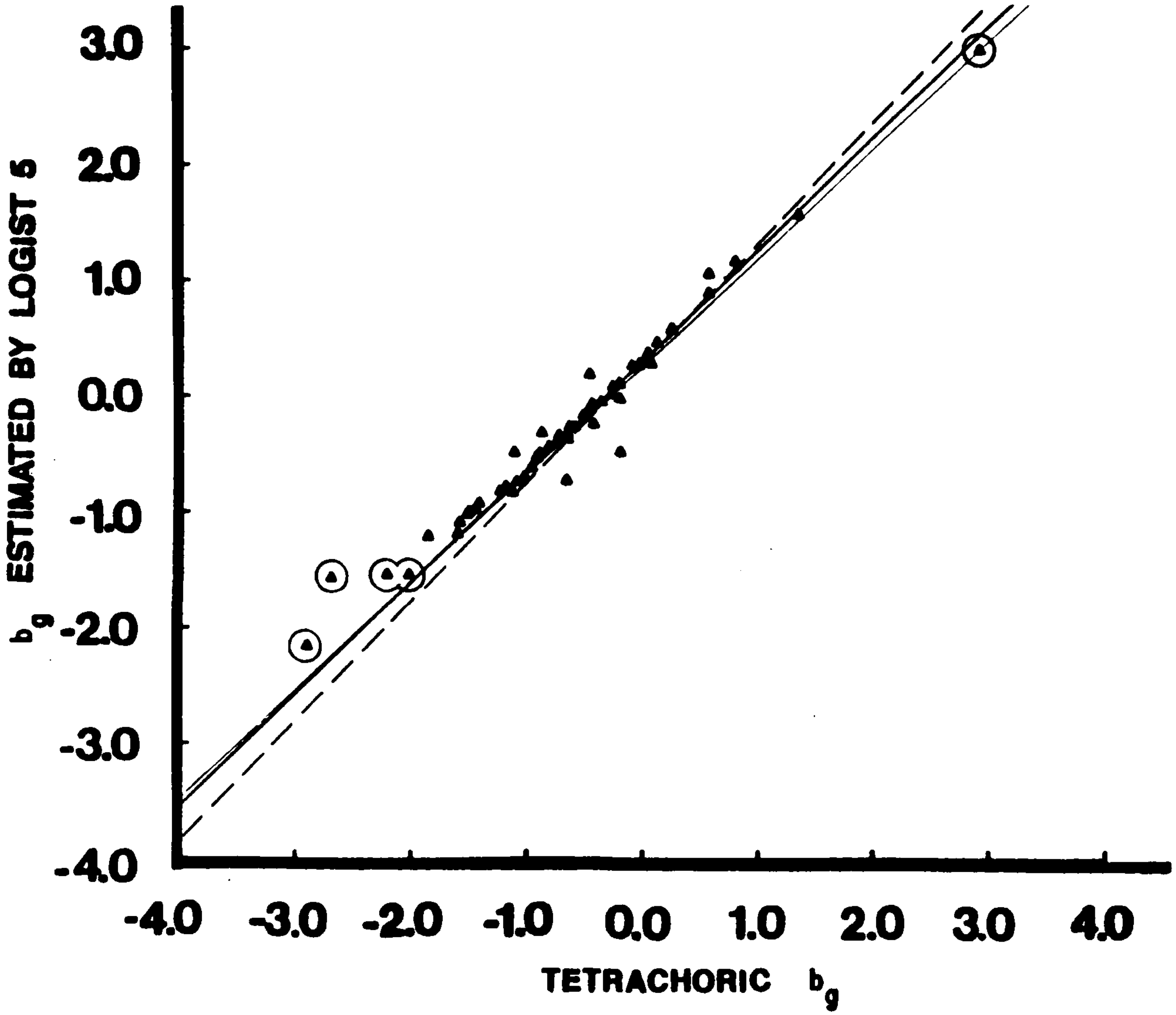


FIGURE 7-2 (Continued,

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

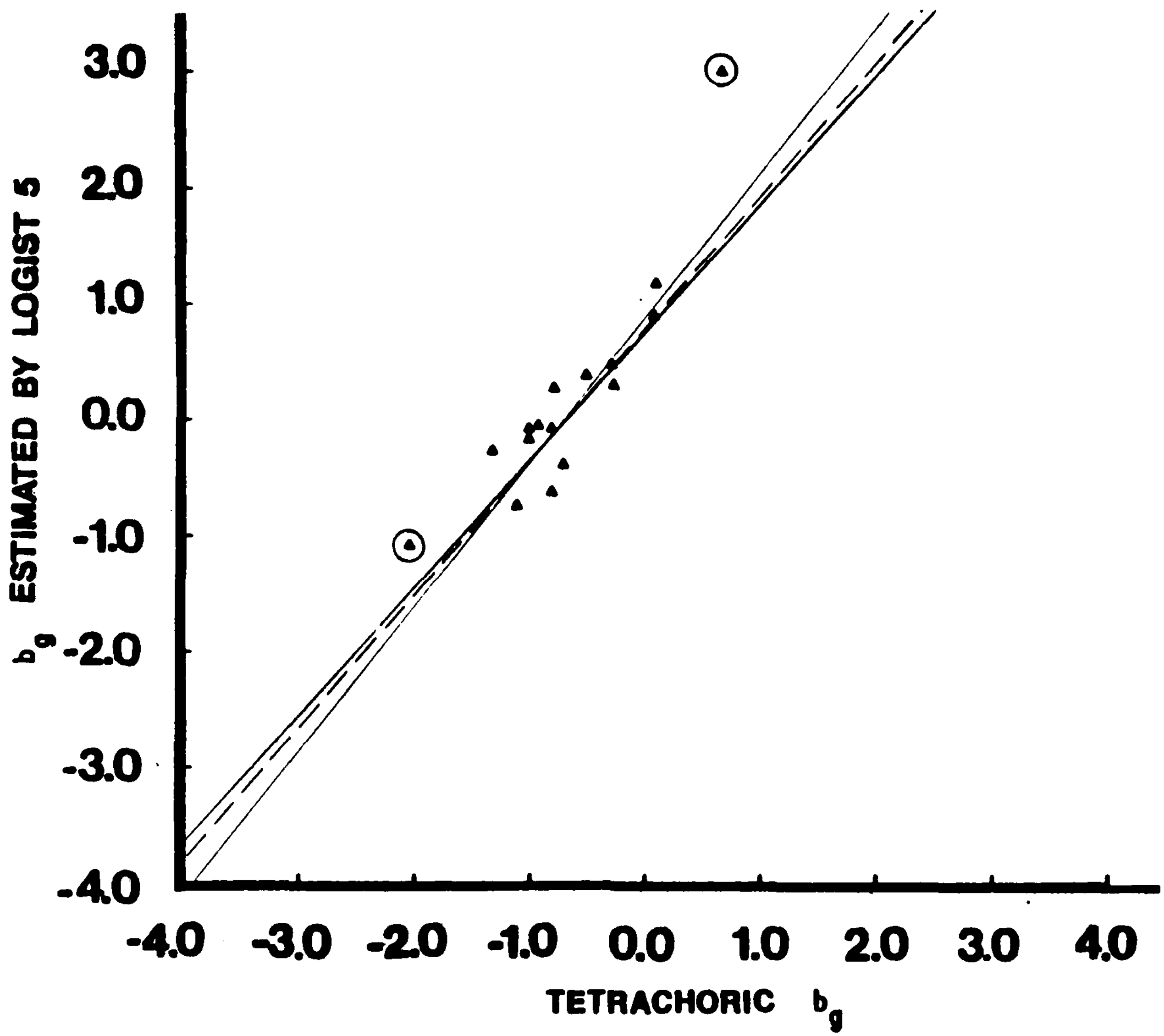


FIGURE 7-2 (Continued)

For the 16 Items Overlapping in Tests A6 and J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

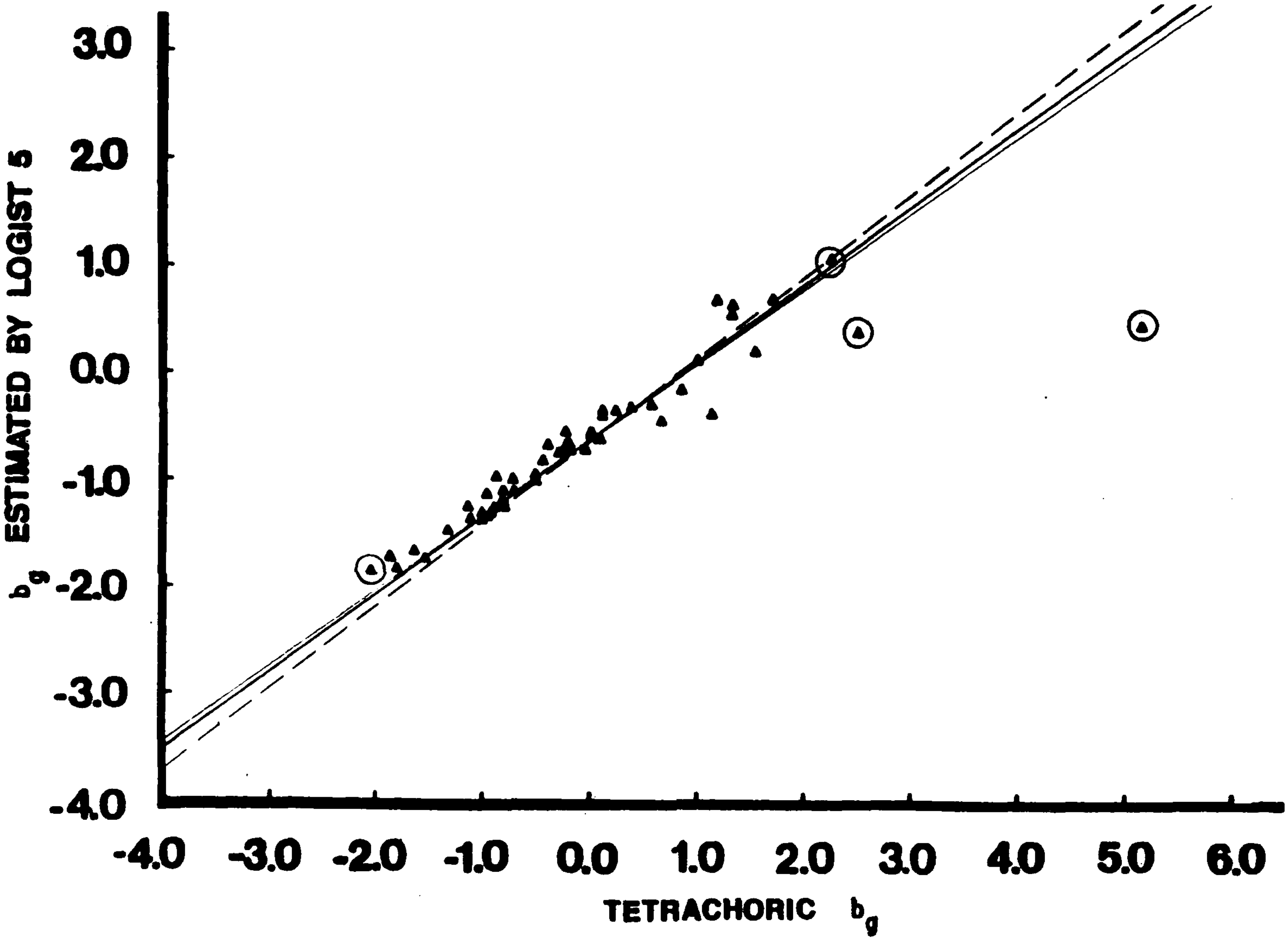


FIGURE 7-2 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

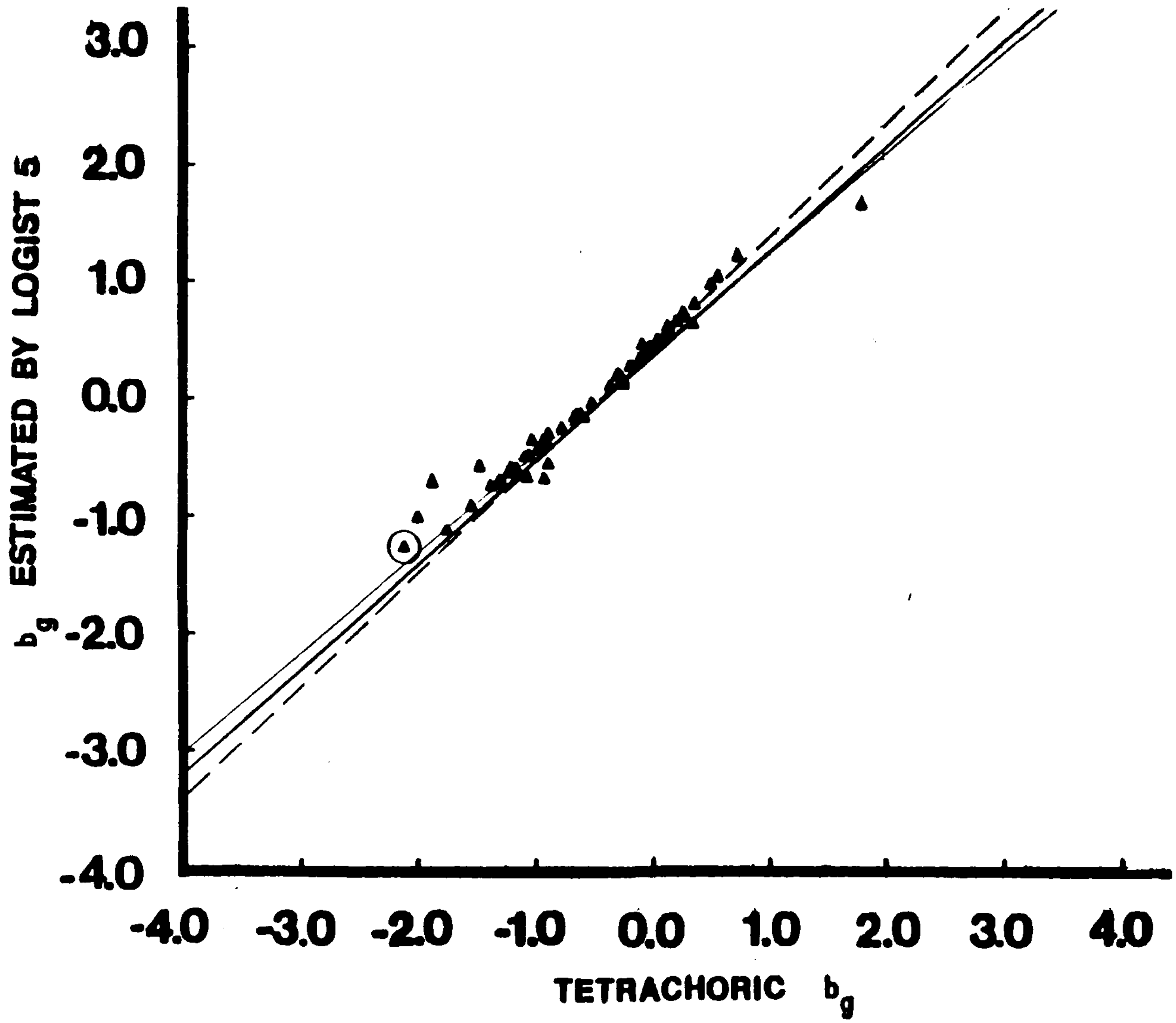


FIGURE 7-2 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

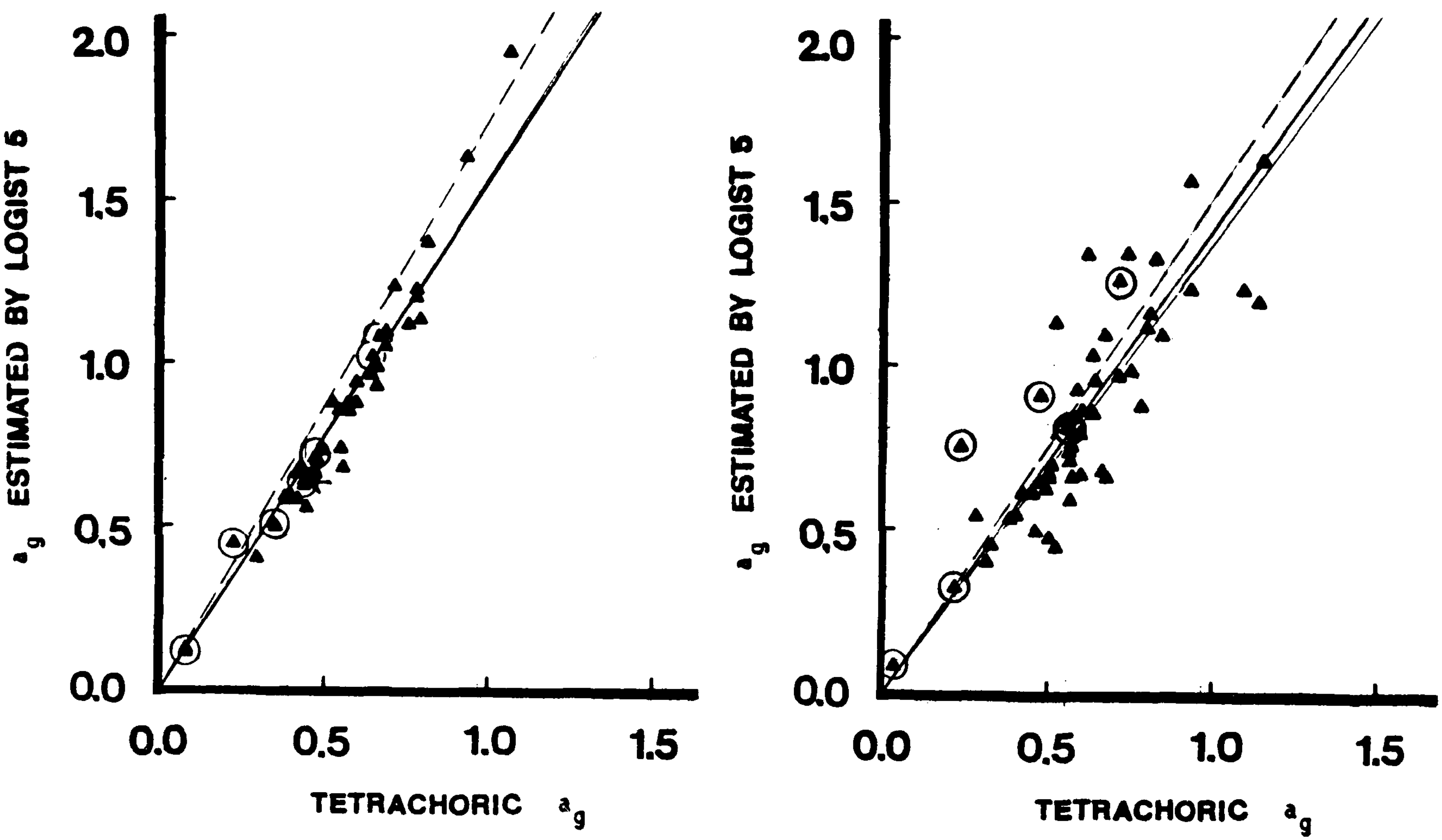


FIGURE 7-3

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6-J1-J2 on the Ordinate.

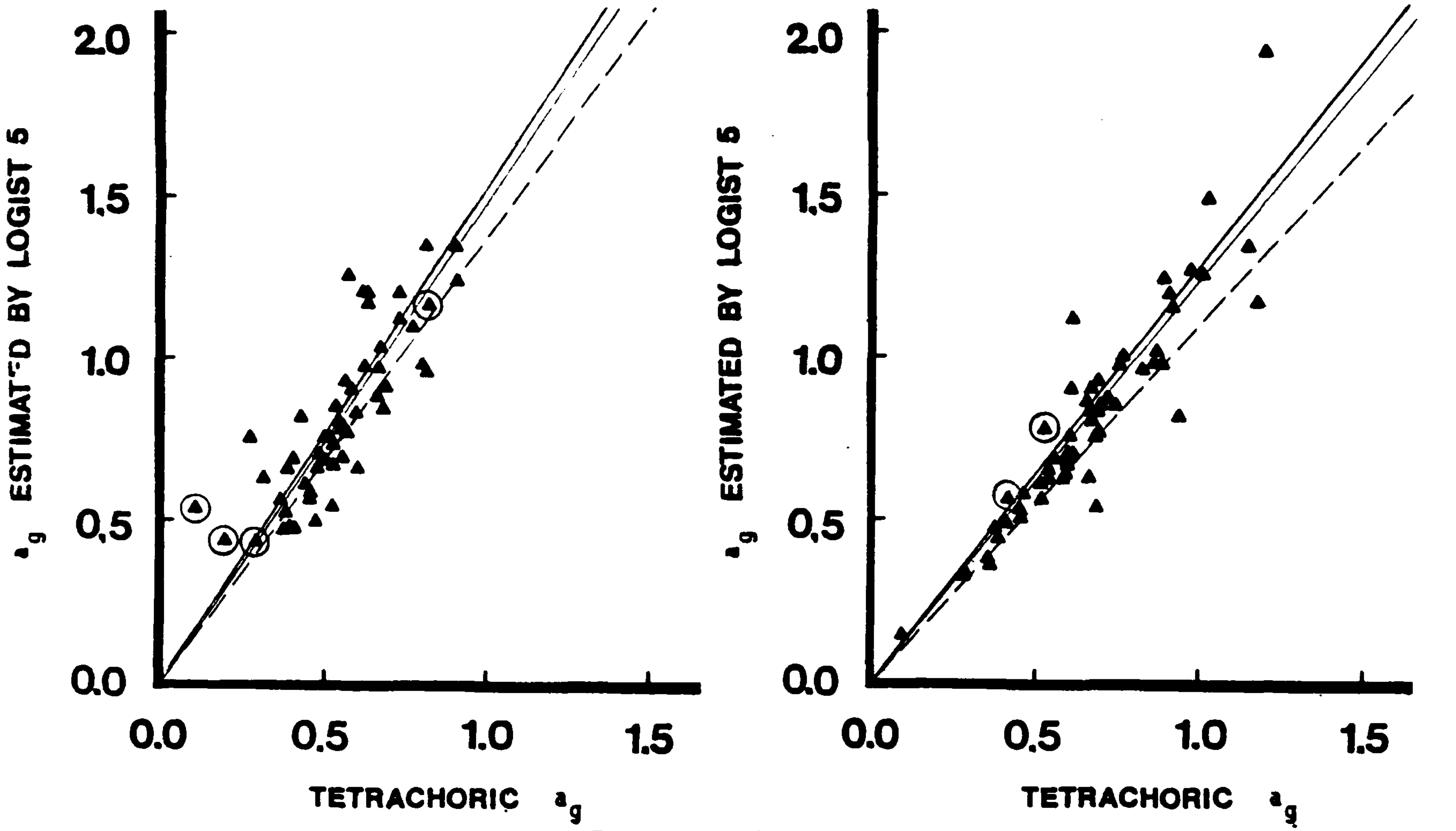


FIGURE 7-3 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

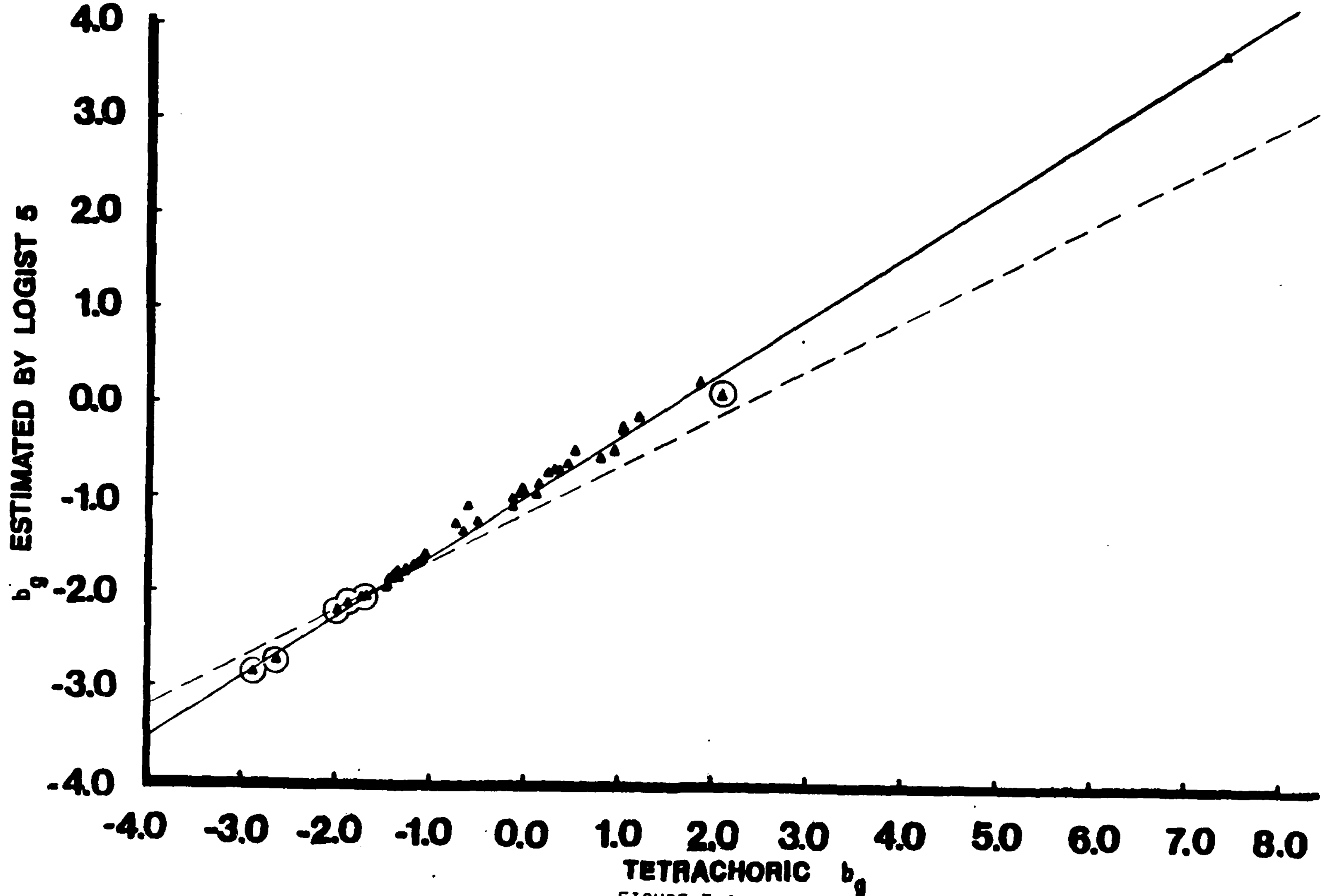


FIGURE 7-4

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. Both Sets of Estimates Are the Original Ones, i.e., before Any Scale Adjustment. For the 44 Items of Test A5 Excluding Item A531 Based upon the A5/O599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

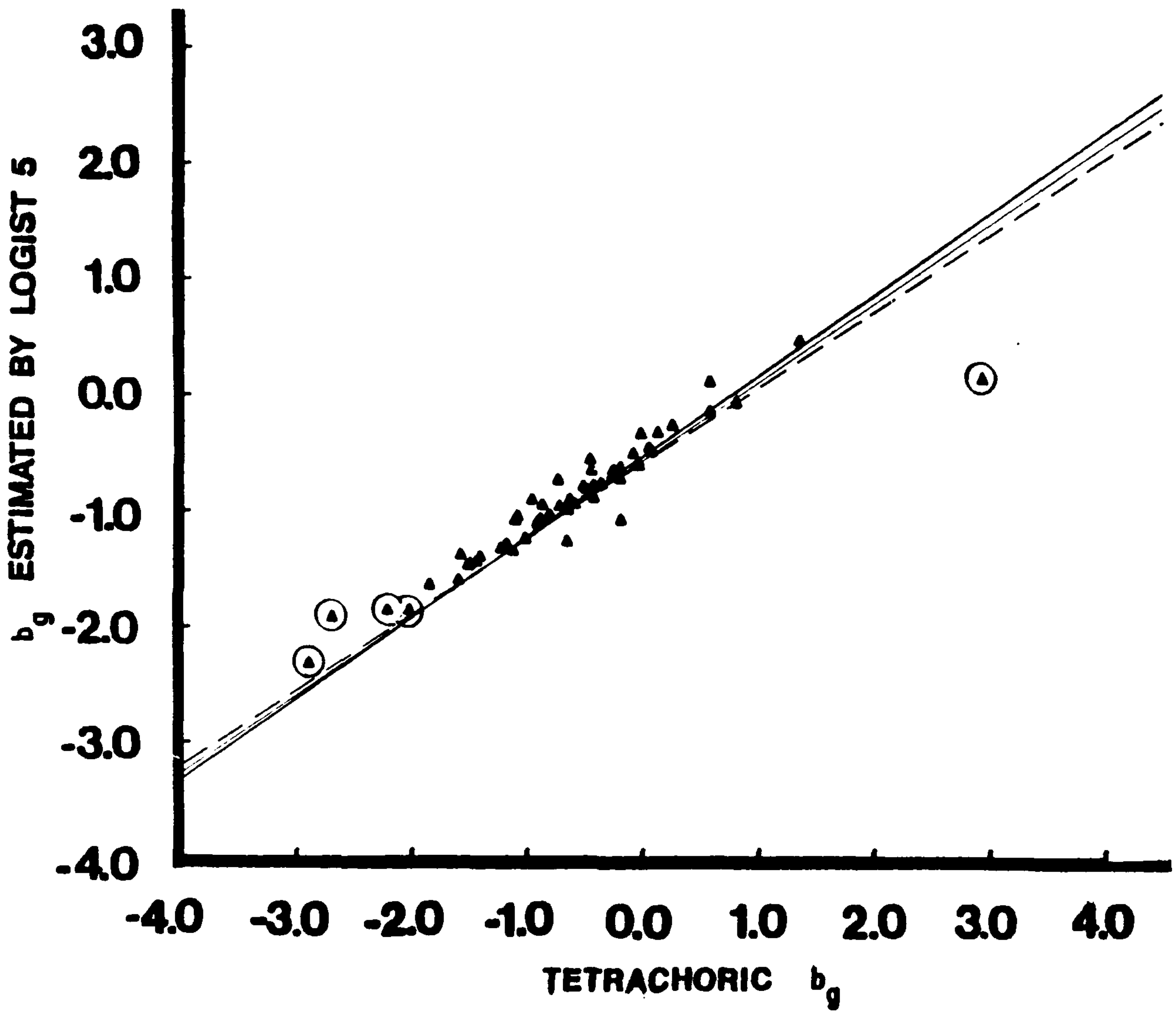


FIGURE 7-4 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

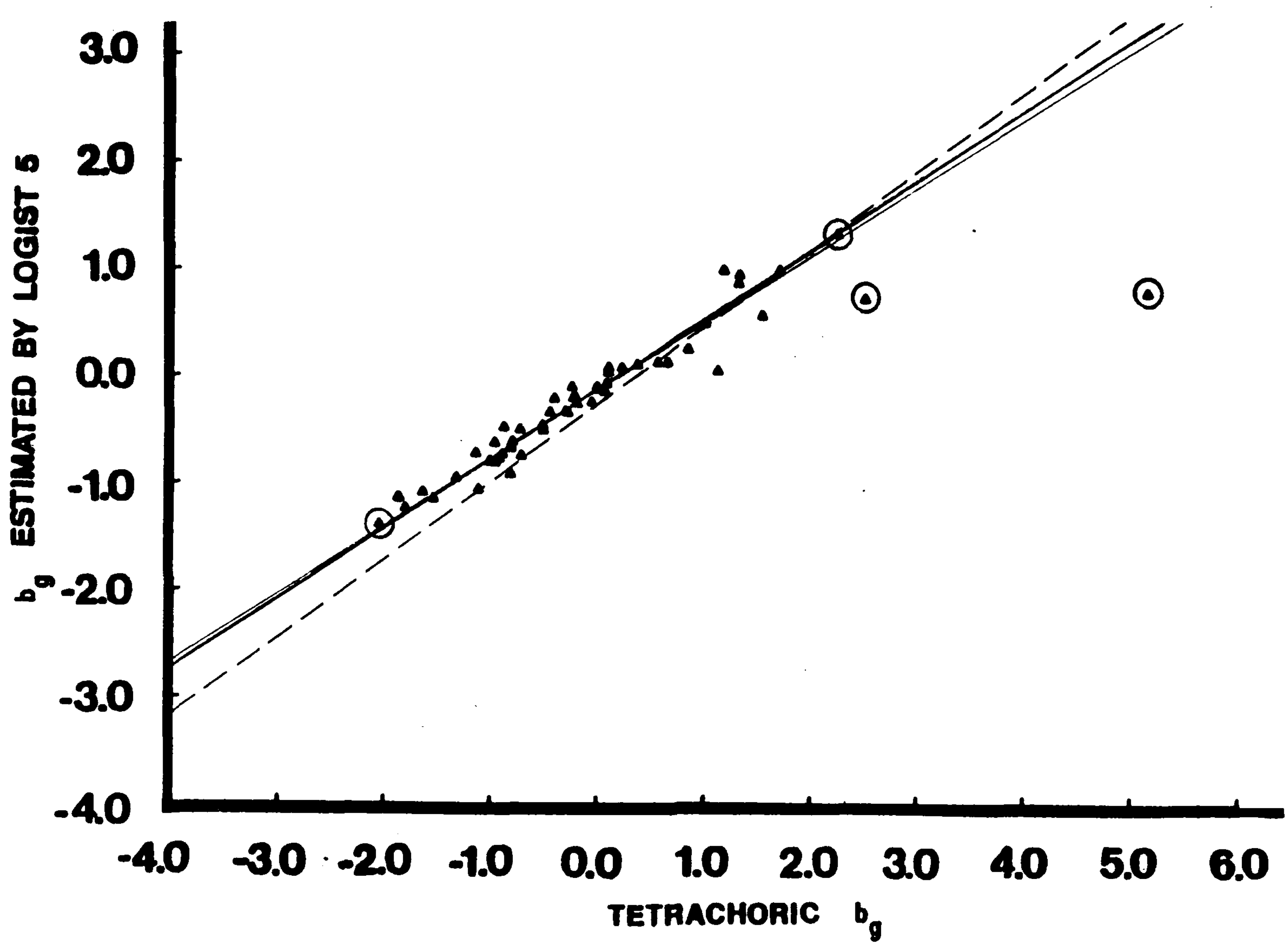


FIGURE 7-4 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

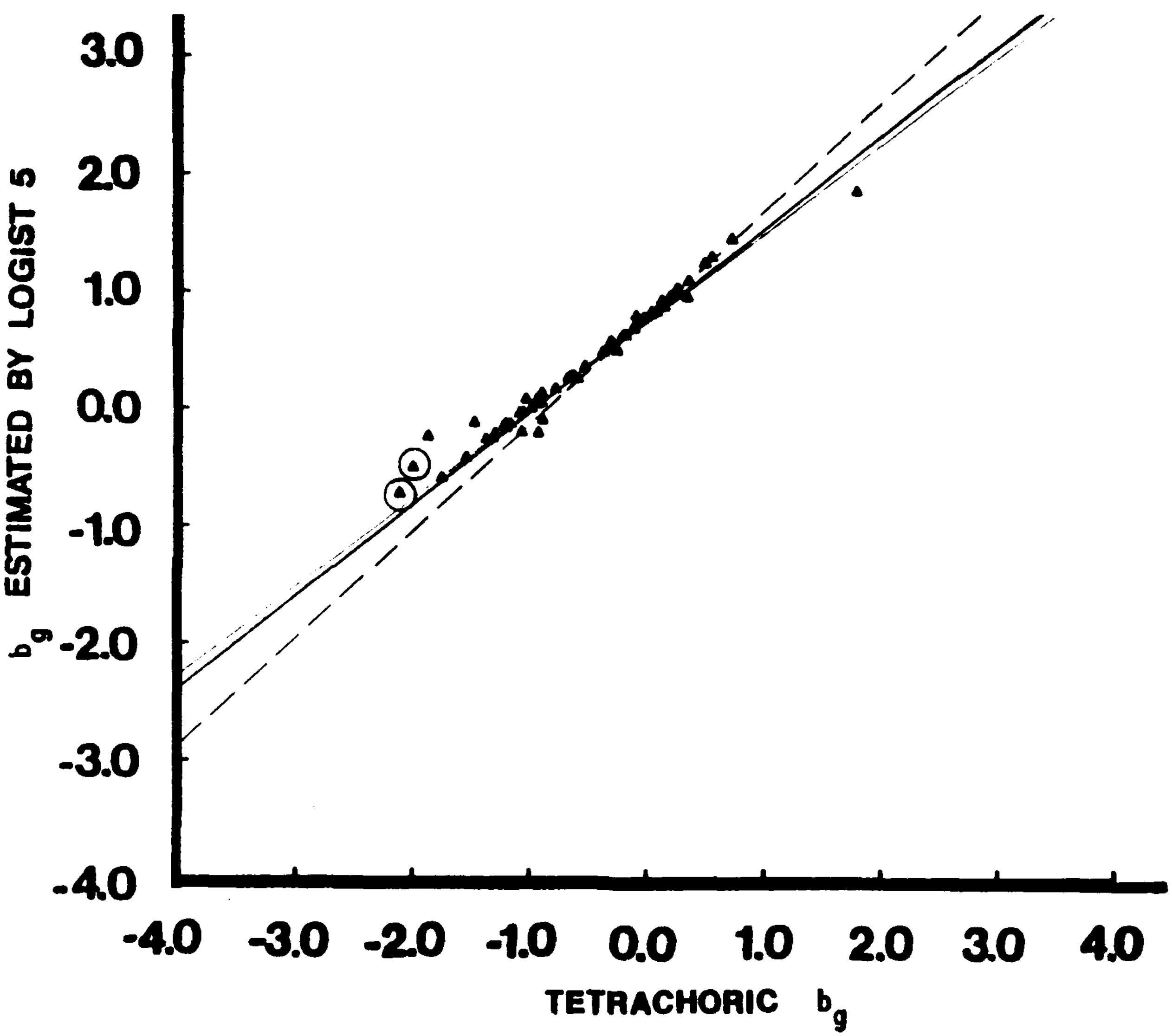


FIGURE 7-4 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

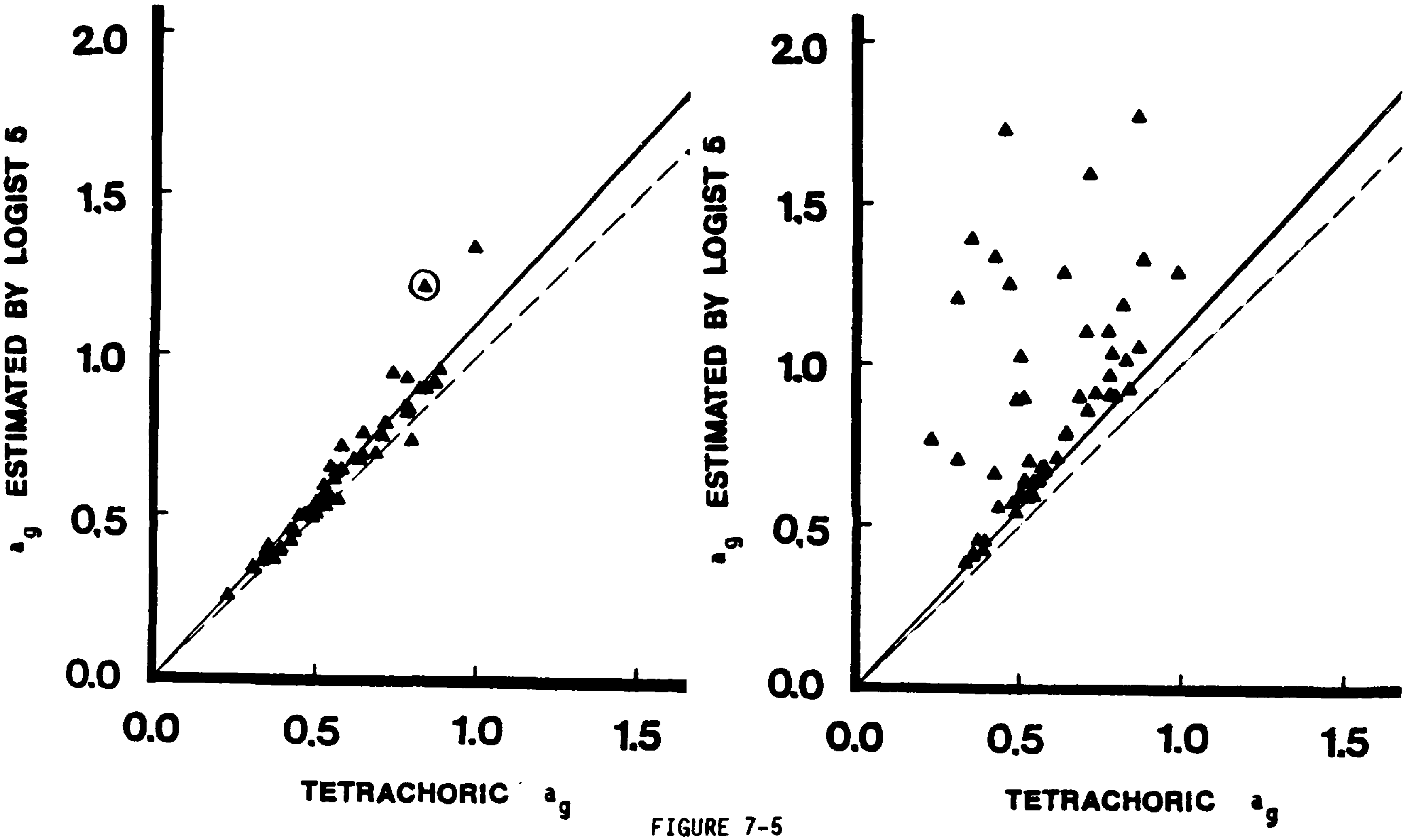


FIGURE 7-5

Estimated Item Discrimination Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. In Using Logist 5, Logistic Model Is Assumed in the Graph on the Left Hand Side And Three-Parameter Logistic Model Is Assumed in the Graph on the Right Hand Side. Both Sets of Estimates in Each Graph are the Original One, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship When the Logistic Model Is Asssumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. J1/1075 Case.

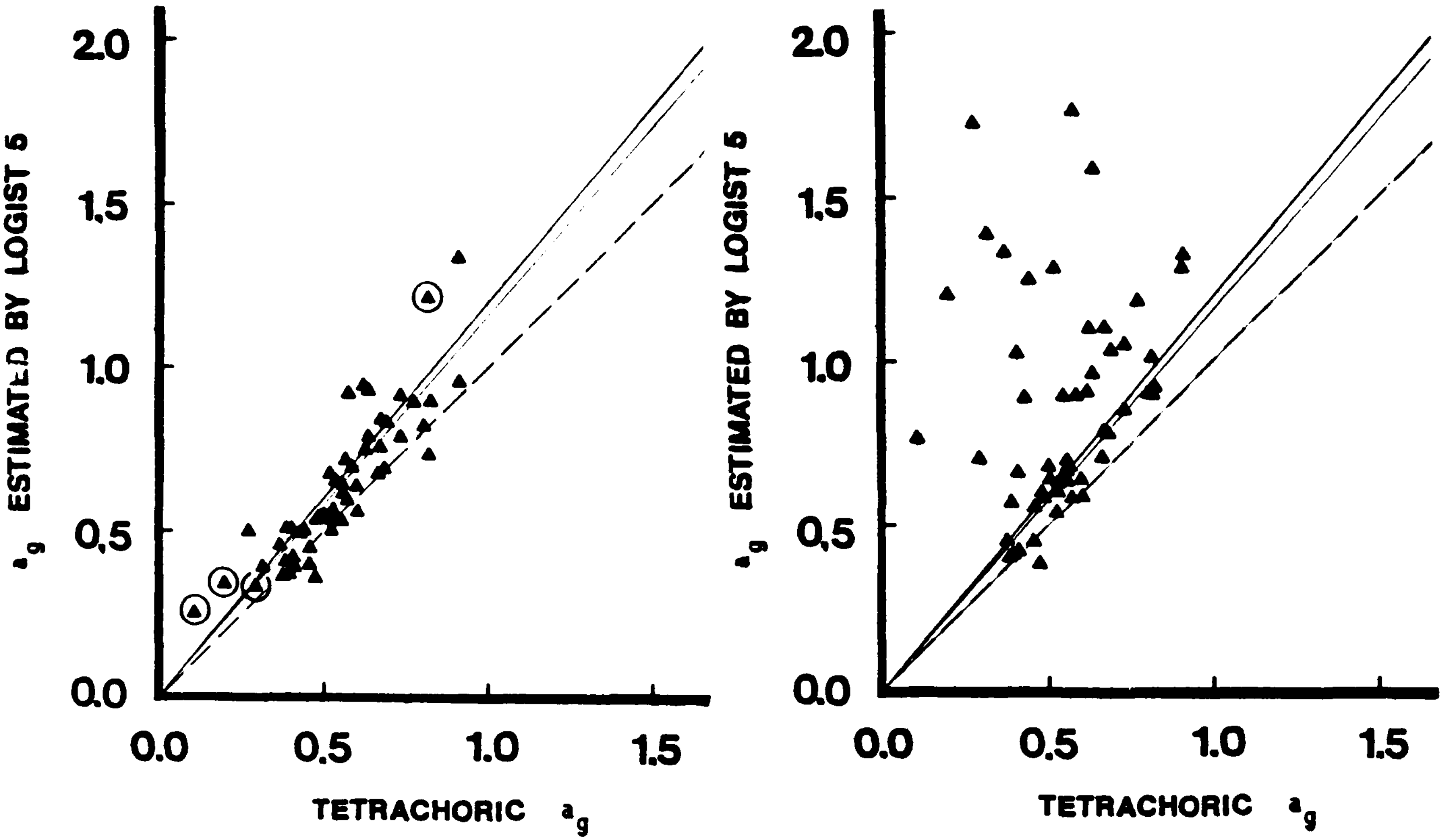


FIGURE 7-5 (Continued)

J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

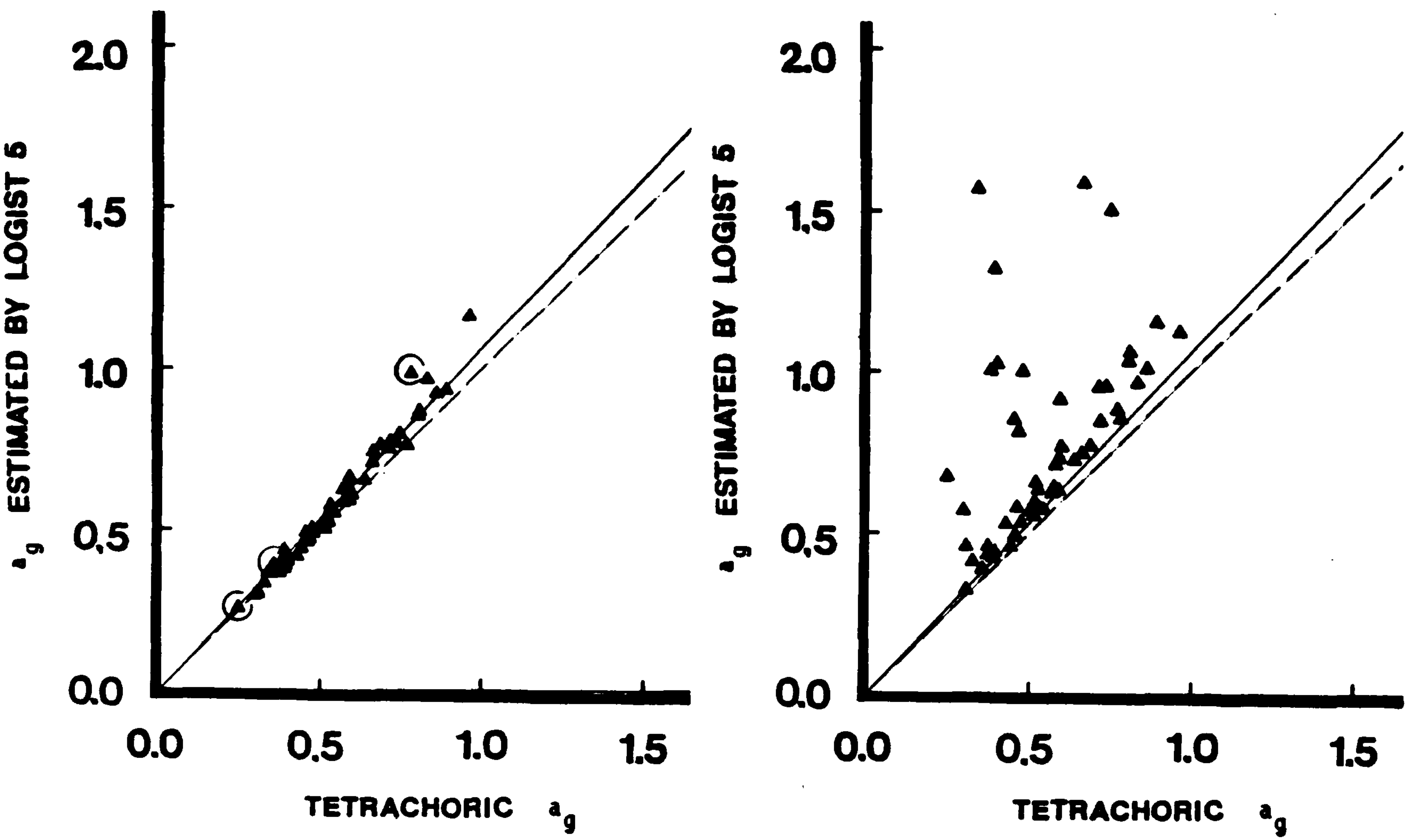


FIGURE 7-5 (Continued): J1/2259 Case.

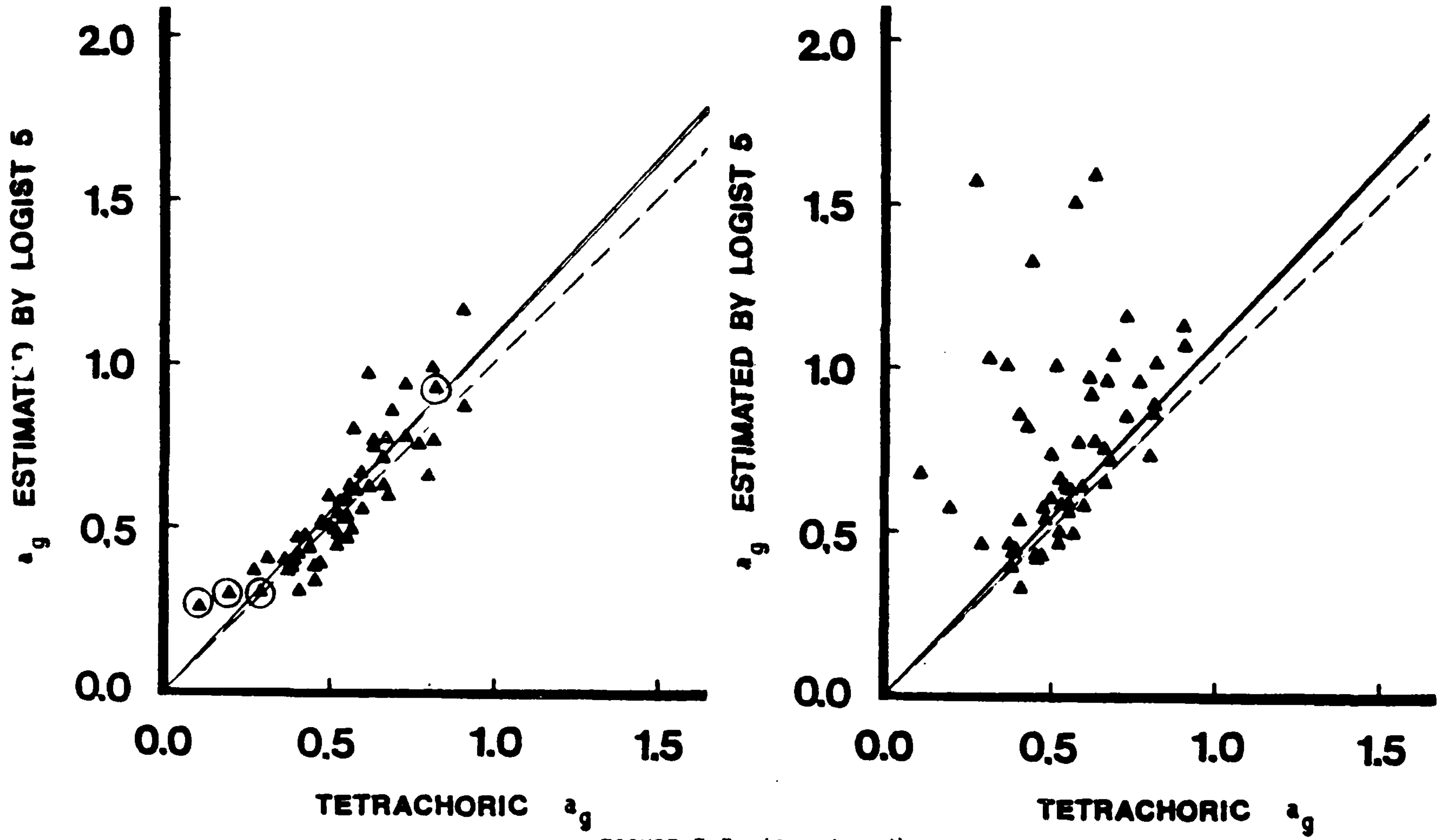


FIGURE 7-5 (Continued)

J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

each of which the Logist 5 results of "c_g-Zero" and "c_g-Free" are compared. The first two pairs concern with Case J1/1075 and the last two with Case J1/2259. In the first pair, these results are plotted against those of J1/1075 Case of the Tetrachoric Method, and in the second they are plotted against the results of J1/0614 Case of the Tetrachoric Method. In the third pair, the results of Case J1/2259: c_g-Zero and c_g-Free are plotted against those of J1/2259 Case of the Tetrachoric Method, and and in the fourth pair, they are plotted against the results of J1/0614 Case of the Tetrachoric Method. We can see a substantial consistency between the two sets of estimated item discrimination parameters in the first graph of each of the four pairs, i.e., when (two-parameter) logistic model is assumed in using Logist 5 , whereas there exists little consistency in the second graph of each pair, i.e., when three-parameter logistic model is assumed. We notice that the greatest consistency is observed in the first graph of the first pair of scatter diagrams and in the first pair of the third pair. They are Case J1/1075: c_g-Zero of Logist 5 against J1/1075 Case of the Tetrachoric Method and Case J1/2259: c_g-Zero against J1/2259 Case, i.e., the only two situations which concern the same examinee group both in using Logist 5 and in using Tetrachoric Method, and no guessing parameter is assumed in using Logist 5 . This fact suggests that these two methods provide us with consistent results when the item parameter configurations are such as those of Test J1, if the sample size is 1,000 or above. The corresponding eight scatter diagrams for the estimated item difficulty parameters are

presented as Figure 7-6. We can see a similar tendency as we have observed for the estimated discrimination parameters, although inconsistency between the two sets of estimates is less conspicuous when three-parameter logistic model is assumed in using Logist 5 .

Figure 7-7 presents four graphs which clarify how estimated item parameters differ when three-parameter logistic model is assumed in comparison with those when (two-parameter) logistic model is assumed. The first two graphs concern with the group of 1,075 examinees and the last two with the group of 2,259 examinees, and in each pair the first graph concerns with the adoption of the (two-parameter) logistic model and the second with the three-parameter logistic model. In each graph, the estimated item difficulty parameters of the items of Test J1 are taken on the abscissa, and the estimated discrimination parameters are taken on the ordinate. Both the results of the Tetrachoric Method and those of Logist 5 are plotted in each of the four graphs, to make the total number of points 110. To avoid confusion, there are five different symbols, i.e., ▲ , ✱ , ♠ , ◆ and + , in these graphs, and an arrow is drawn for each item from the point indicating the result of the Tetrachoric Method to that of Logist 5 .

Comparison of the first graph of Figure 7-7 with the second, and of the third graph with the fourth, excloses how radically the two estimated parameters of these items of Test J1 are enhanced because of the existence of the guessing parameter c_g when three-parameter logistic model is assumed in using Logist 5 . These tendencies are

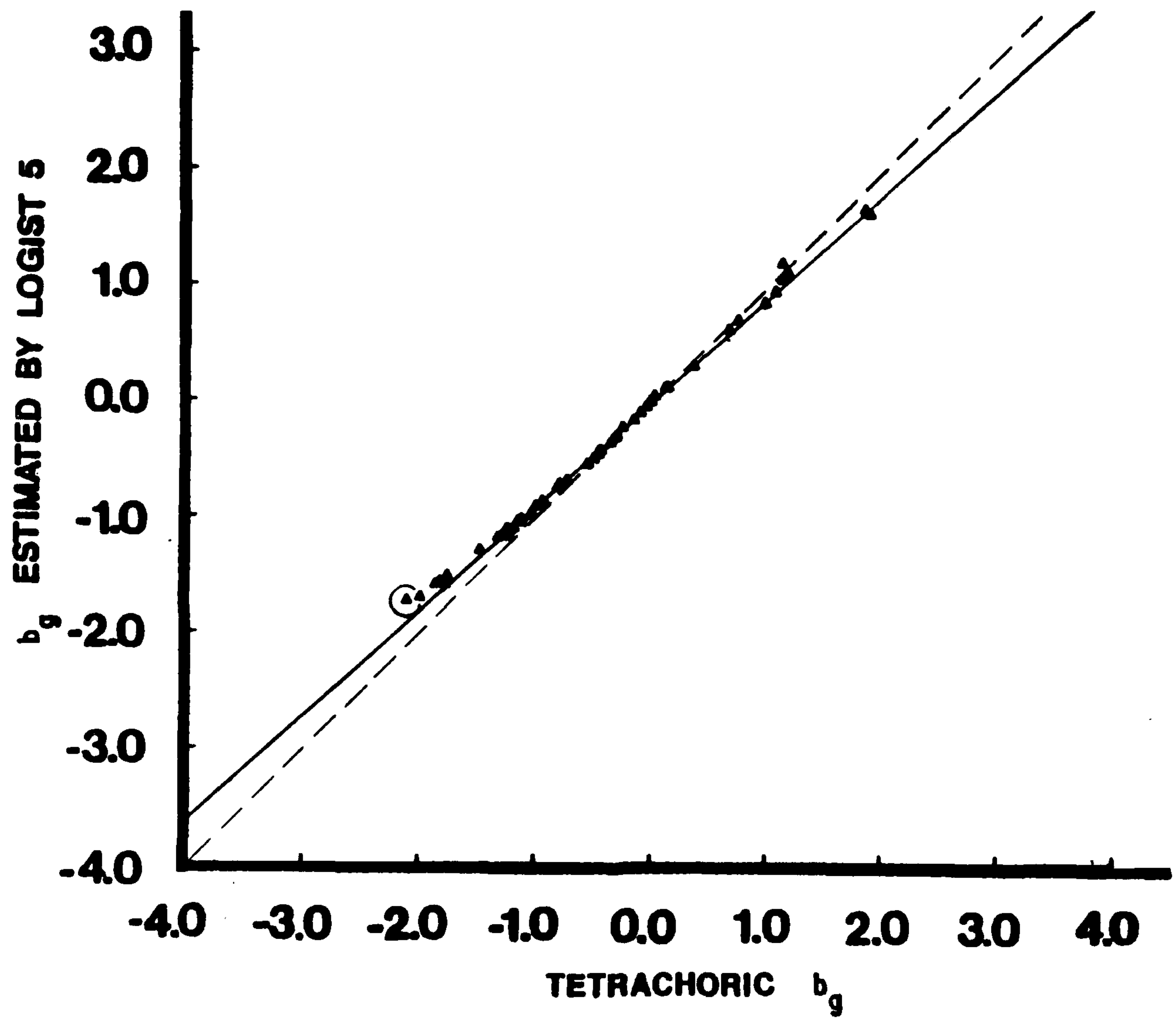


FIGURE 7-6

Estimated Item Difficulty Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method. Both Sets of Estimates in Each Graph Are the Original One, i.e., before Any Scale Adjustment. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

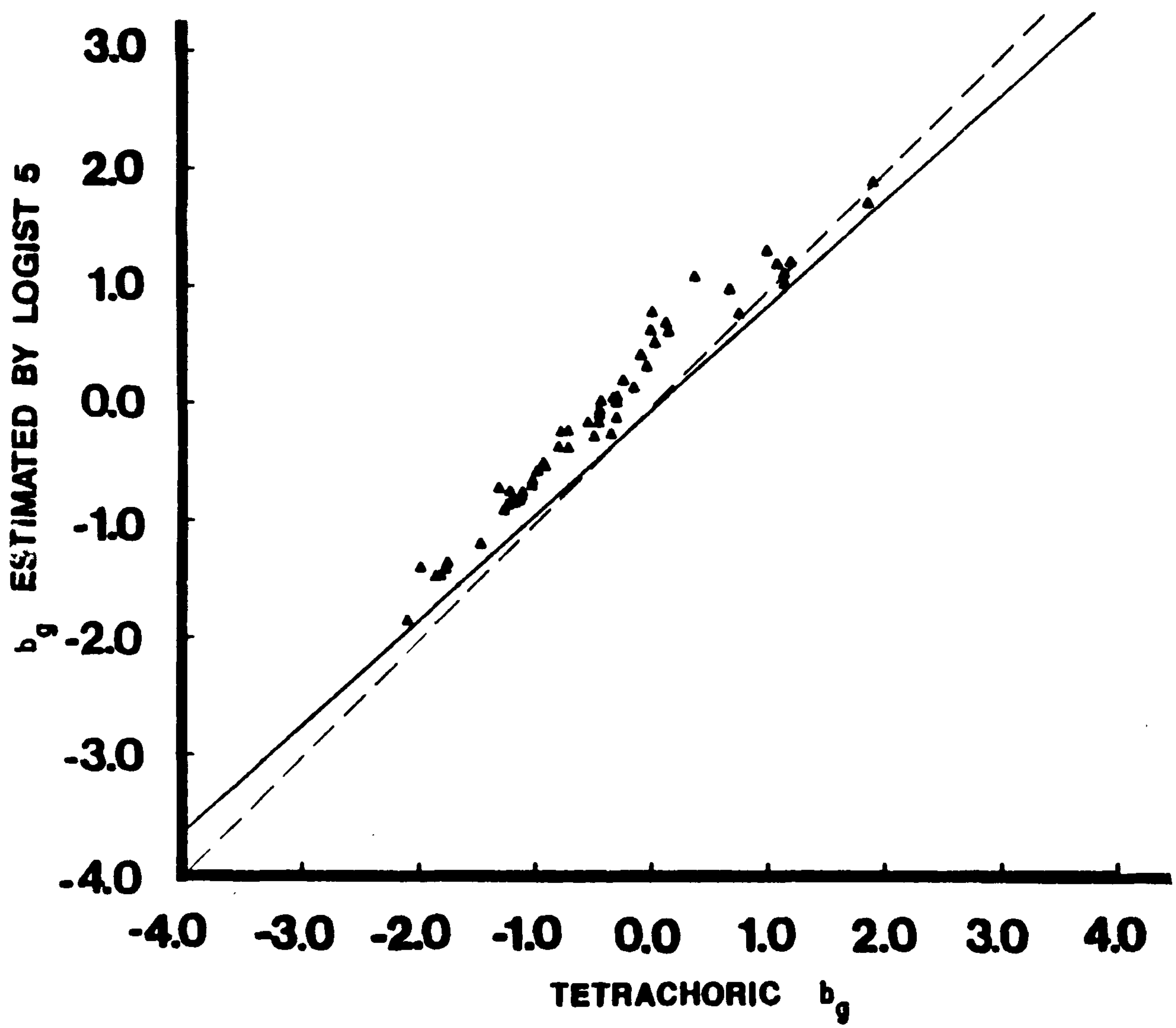


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

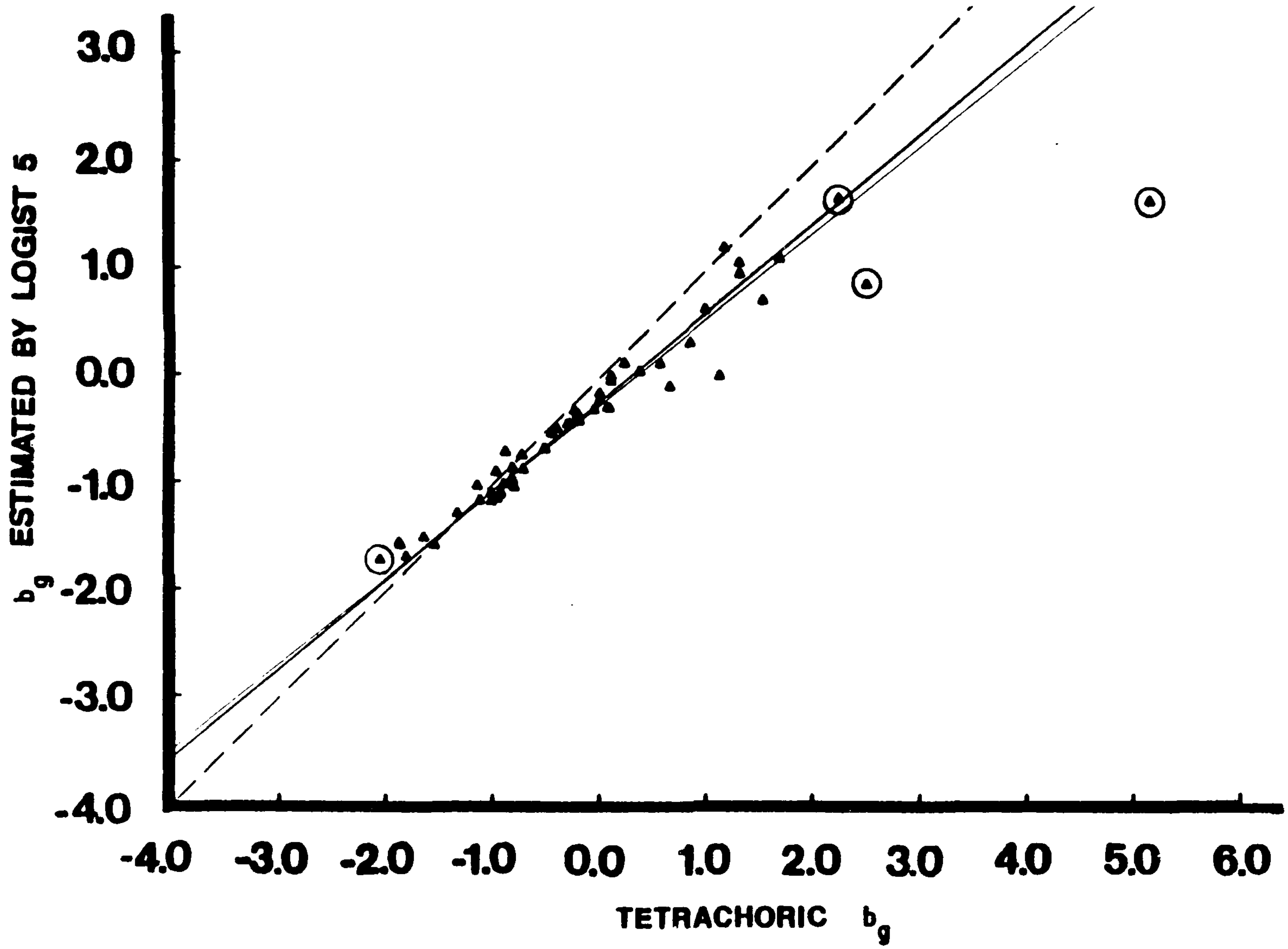


FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

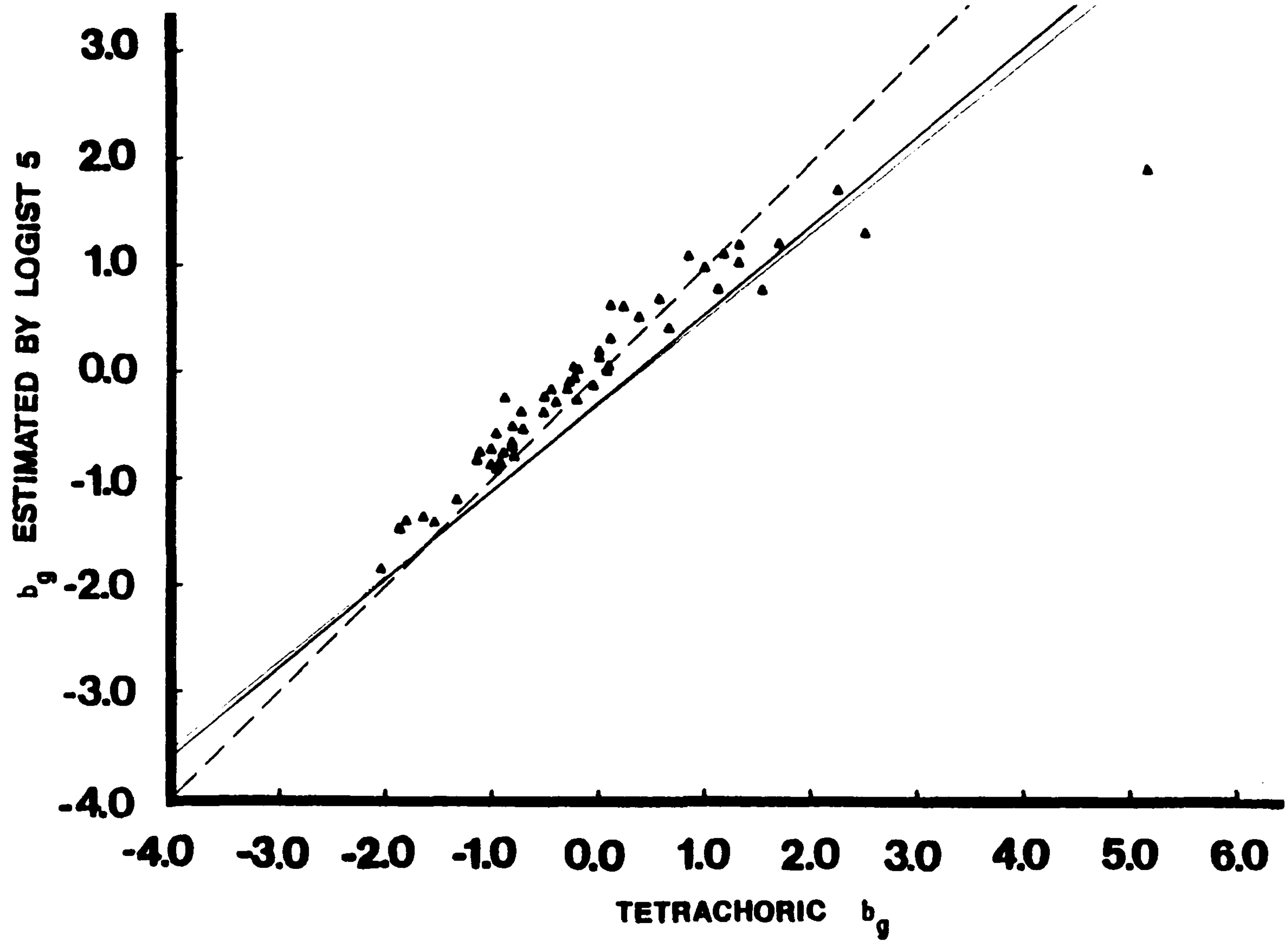


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

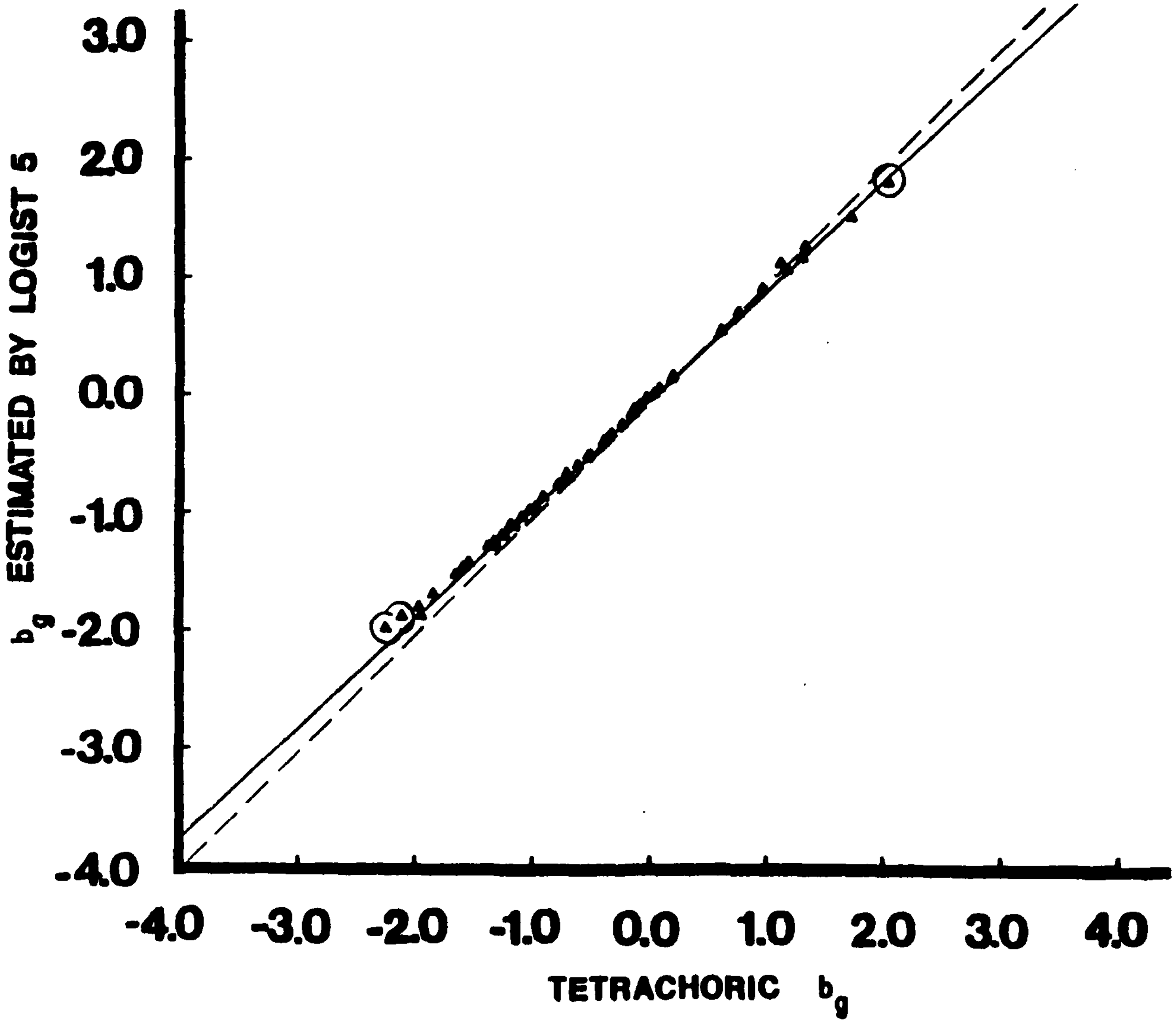


FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

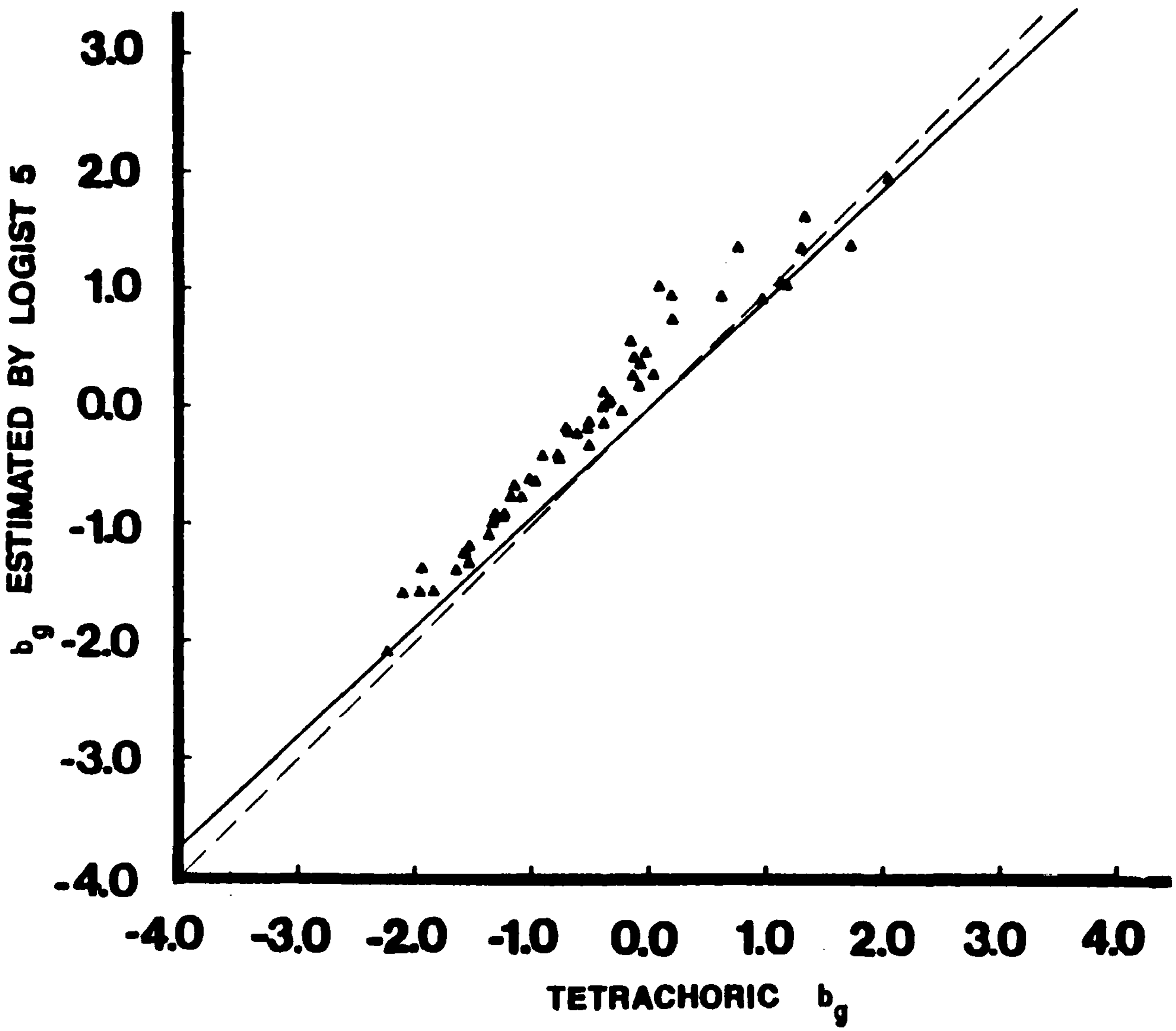


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

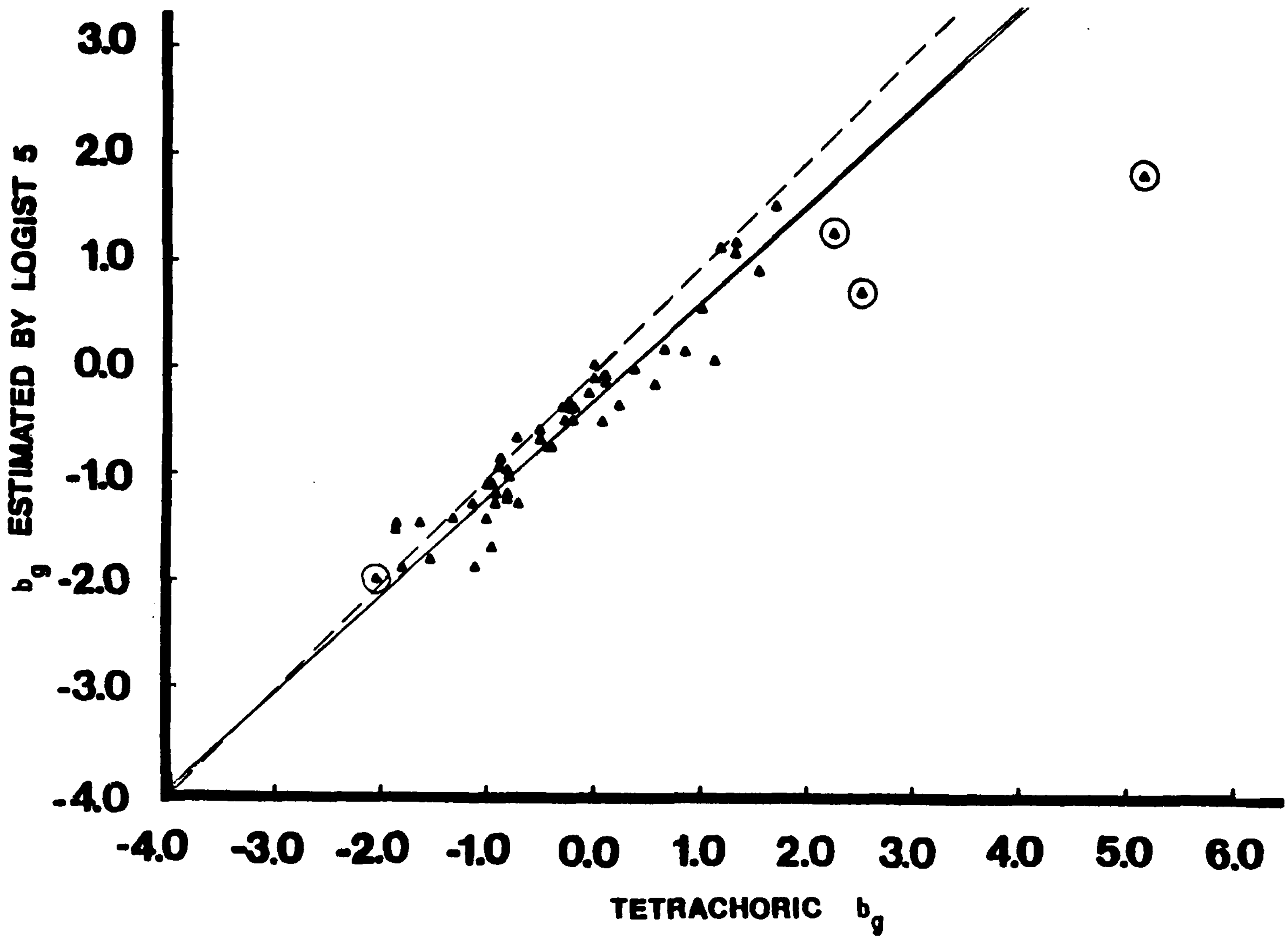


FIGURE 7-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

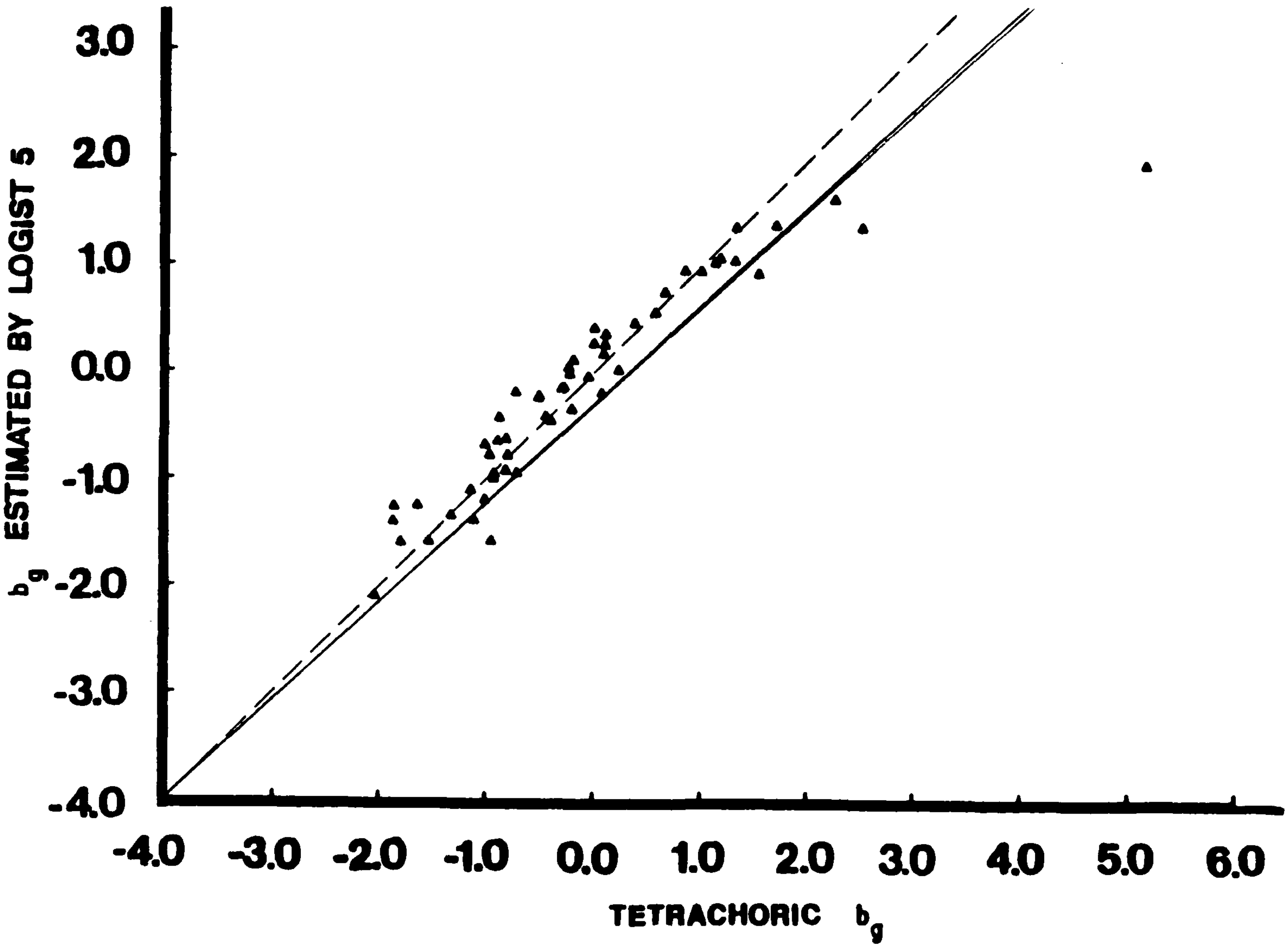


FIGURE 7-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

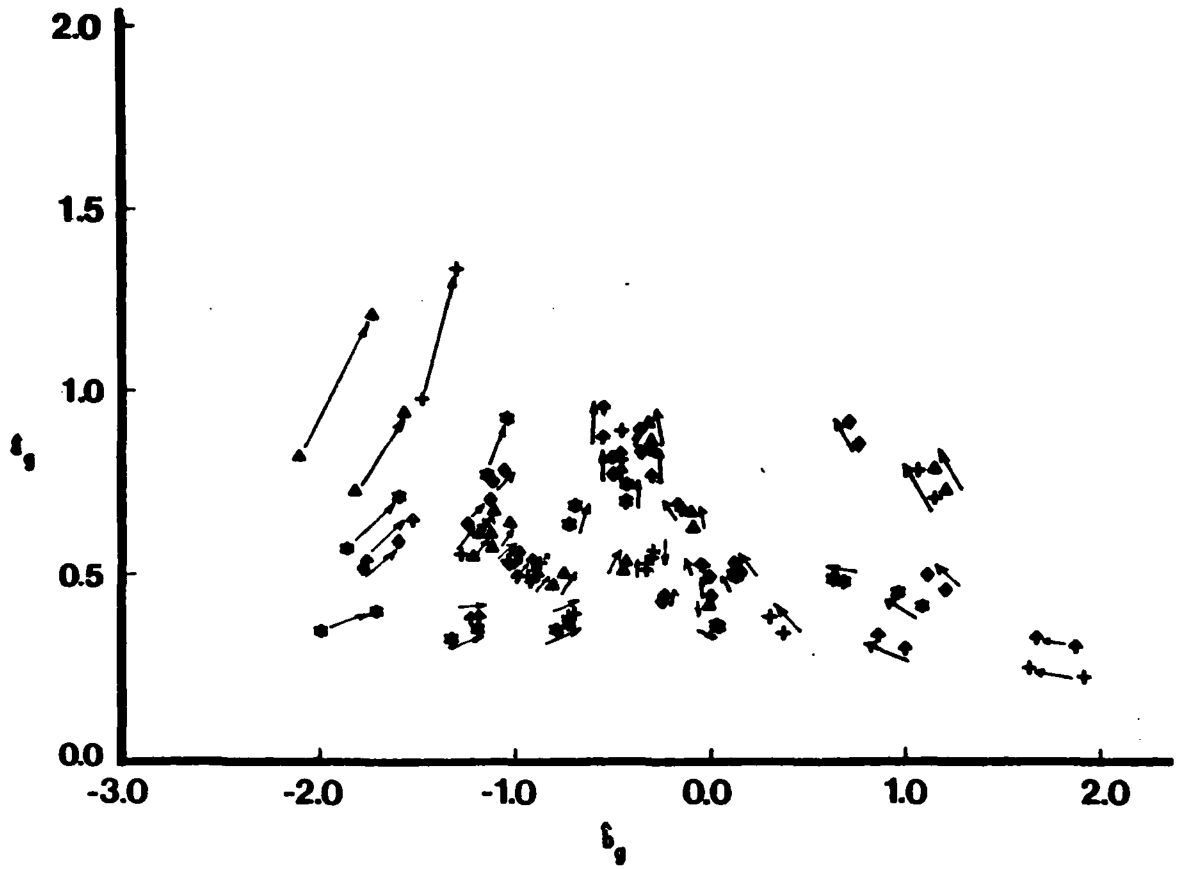


FIGURE 7-7

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$, Which Were Obtained by the Tetrachoric Method Applied for the J1/1075 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming (Two-Parameter) Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

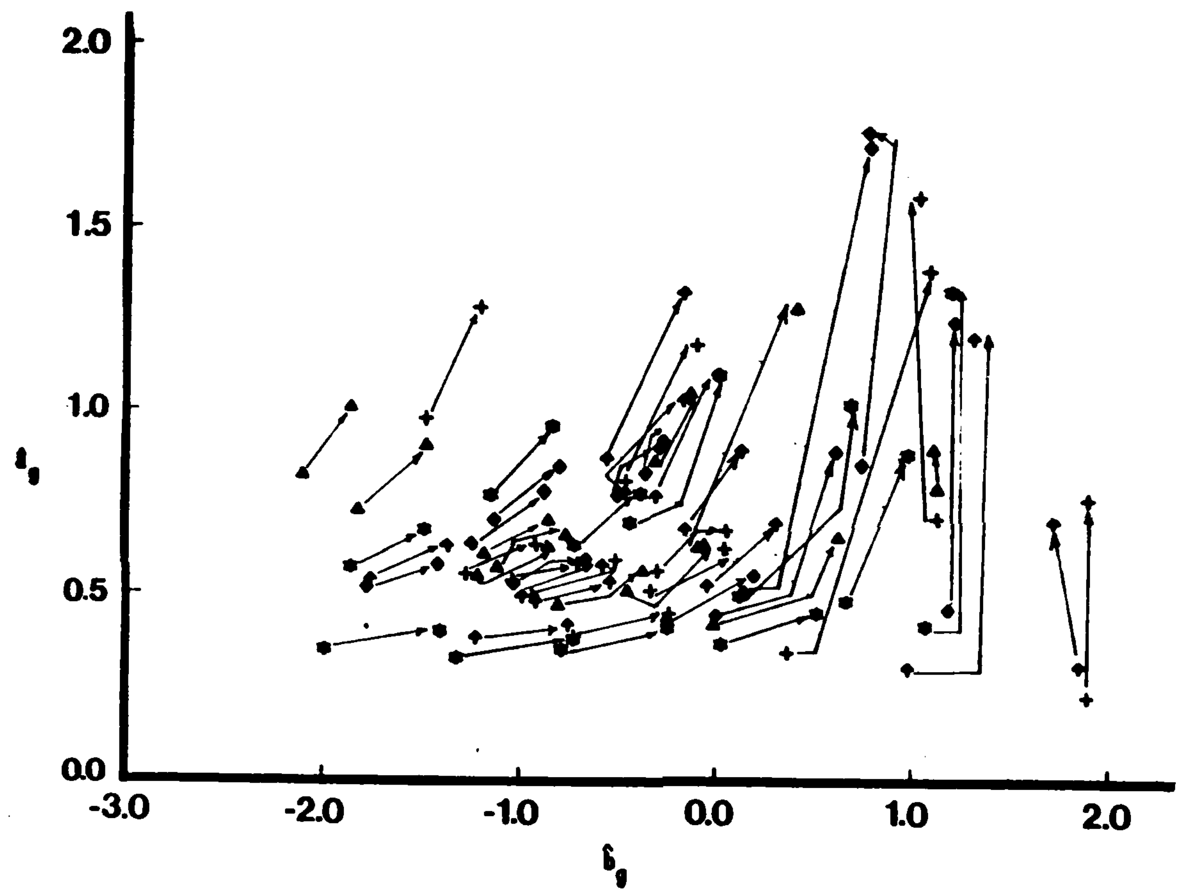


FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$, Which Were Obtained by the Tetrachoric Method Applied for the J1/1075 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming Three-Parameter Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

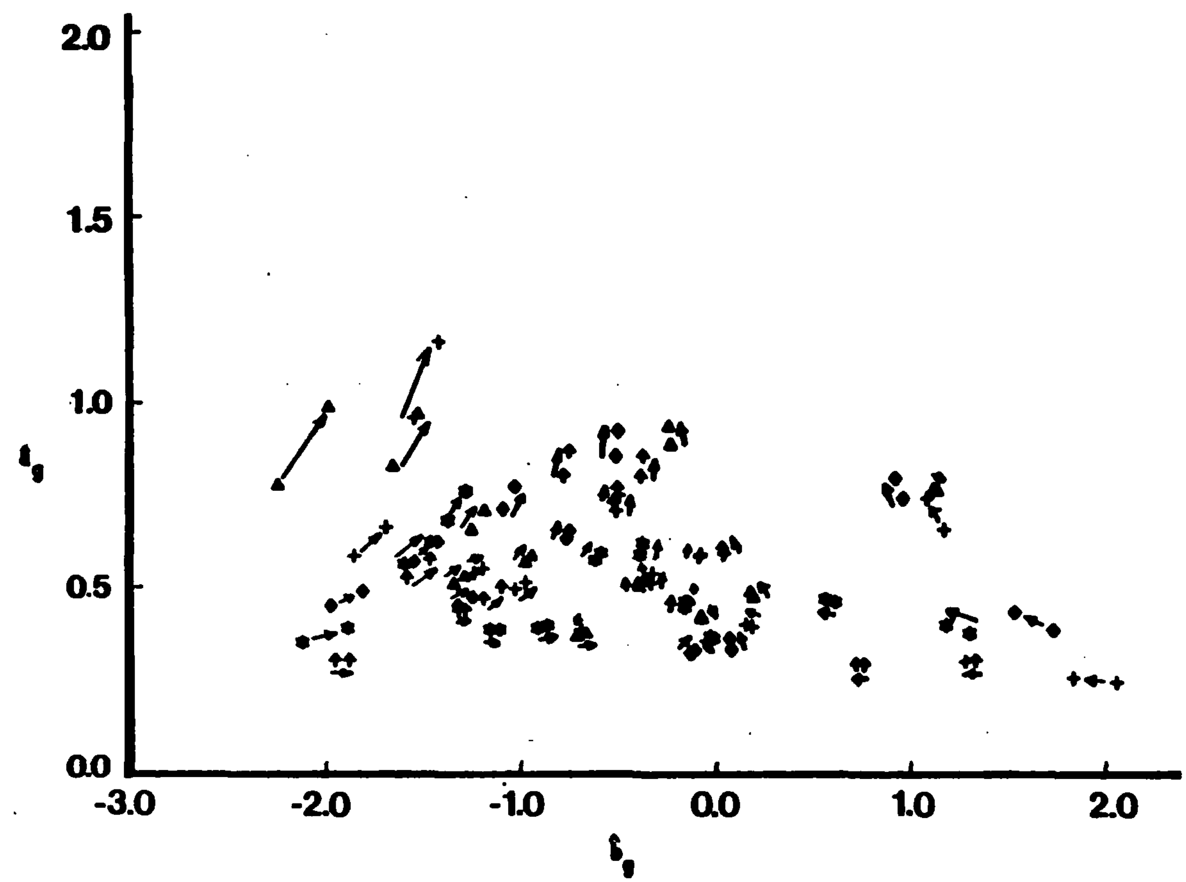


FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$, Which Were Obtained by the Tetrachoric Method Applied for the J1/2259 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming (Two-Parameter) Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

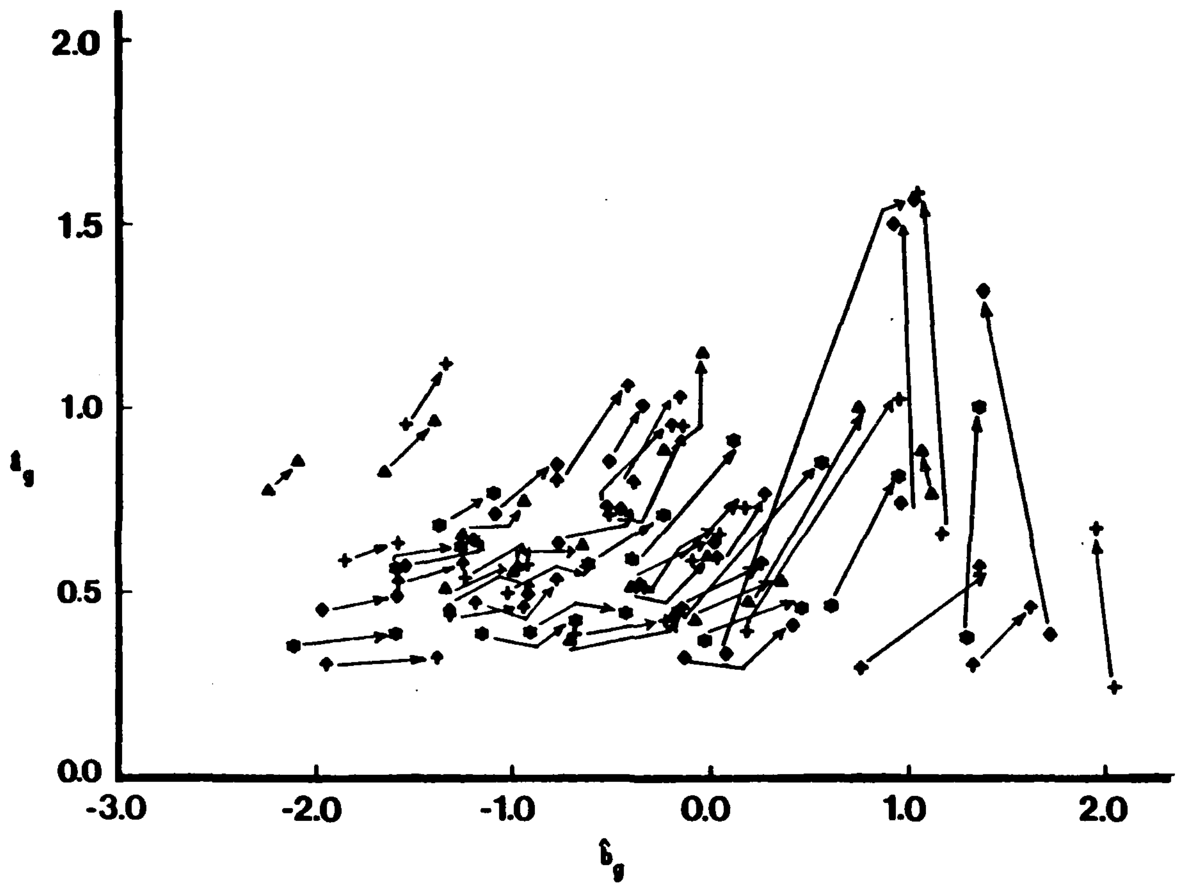


FIGURE 7-7 (Continued)

Estimated Item Discrimination Parameter $\hat{a}_g$ Plotted against Estimated Difficulty Parameter $\hat{b}_g$, Which Were Obtained by the Tetrachoric Method Applied for the J1/2259 Case, And Those Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming Three-Parameter Logistic Model, for Each of the 55 Items of Test J1. For Each Item, an Arrow Is Drawn from the Tetrachoric Method Result to the Logist 5 Result.

similarly observed in both pairs, where the examinee groups of 1,075 individuals and of 2,259 examinees are involved, respectively.

We assume, tentatively, that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ equals those of θ for each examinee group. We recall that, in the preceding section, we obtained the estimated mean and the standard deviation of the distribution of θ for each of the three combined groups, and they are presented at the bottom of Table 6-3. Thus using the estimated mean and standard deviation of θ for each of the three combined examinee groups, and for each of J1/1075 and J1/2259 Cases, which are presented in Table 6-3 in the preceeding section, the scale adjustment was made in the same way as we did for the results of the Tetrachoric Method. The resulting "rescaled" estimated item parameters are shown in Tables 7-13 through 7-24, for each item of Tests A5, A6, J1 and J2, which were originally obtained by Logist 5 in Cases A5-A6, J1-J2, A5-A6-J1-J2, J1/1075: c_g-Zero, J1/1075: c_g-Free, J1/2259: c_g-Zero, and J1/2259: c_g-Free, respectively. Again in these tables, for convenience, extreme values of a_g and b_g in Tables 7-13 through 7-21 and in Table 7-23 are marked with ● in the same way as we did in Tables 6-4 through 6-9. Note that these marks indicate extreme deviation with respect to the origin and unit of the single scale, which are set equal to the mean and standard deviation of the ability distribution of the J1/0614 Case, respectively, while those marks in each of Tables 7-1 through 7-9 and in Table 7-11 do with respect to the origin and unit which are set equal to the mean and

TABLE 7-13

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
A501	0.922	-2.221
A502	0.643	-3.099●
A503	0.733	-3.224●
A504	0.770	-1.999
A505	0.971	-2.301
A506	0.576	-1.984
A507	0.614	-0.997
A508	0.948	-1.805
A509	1.768	-1.904
A510	0.793	-0.986
A511	0.597	-2.097
A512	0.851	-1.877
A513	1.271	-2.636
A514	1.111	-1.831
A515	0.590	-2.206
A516	0.526	0.323
A517	2.186	-2.243
A518	0.462	-2.382
A519	0.868	-1.912
A520	0.451	-2.965
A521	0.792	-1.886
A522	0.503	-0.714
A523	0.103	4.123●
A524	0.541	-1.993
A525	1.239	-1.943
A526	1.088	-0.883
A527	0.109	-0.480
A528	0.526	-0.205
A529	0.661	-0.638
A530	0.775	-1.715
A531	0.036●	35.061●
A532	0.632	-0.084
A533	0.978	-1.779
A534	1.011	-2.091
A535	0.781	-1.333
A536	0.819	-1.151
A537	0.594	-1.359
A538	1.456	-1.003
A539	0.877	-1.053
A540	0.523	-0.745

Item	$\hat{a}_g$	$\hat{b}_g$
A541	0.650	-0.937
A542	0.552	-1.451
A543	0.600	-1.145
A544	0.993	-0.561
A545	1.099	-0.717
A546	0.397	0.203
A547	0.354	-0.474
A548	0.583	-0.219

Note: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-14, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-14

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$	Item	$\hat{a}_g$	$\hat{b}_g$
A601	0.978	-1.779	A641	0.724	0.056
A602	1.011	-2.091	A642	0.758	-1.267
A603	0.781	-1.333	A643	0.843	-0.872
A604	0.819	-1.151	A644	1.322	-0.489
A605	0.594	-1.359	A645	0.561	-0.315
A606	1.456	-1.003	A646	0.573	-0.792
A607	0.877	-1.053	A647	0.618	0.296
A608	0.523	-0.745	A648	1.007	-1.675
A609	0.650	-0.937	A649	0.508	-0.793
A610	0.552	-1.451	A650	0.629	-0.393
A611	0.600	-1.145	A651	0.711	-0.959
A612	0.993	-0.561	A652	0.314	-1.062
A613	1.099	-0.717	A653	0.627	-0.768
A614	0.397	0.203	A654	0.280	1.884
A615	0.354	-0.474	A655	0.988	-0.470
A616	0.583	-0.219	A656	0.575	-1.370
A617	1.147	-1.532			
A618	0.588	-1.193			
A619	0.696	-1.180			
A620	1.051	-0.629			
A621	1.016	-0.960			
A622	0.724	-1.614			
A623	0.529	-1.441			
A624	0.701	-2.068			
A625	0.470	-1.764			
A626	0.602	-1.024			
A627	0.388	-0.492			
A628	0.279	-2.600			
A629	0.752	-0.655			
A630	0.736	-1.017			
A631	0.684	-0.853			
A632	0.744	-1.407			
A633	0.460	-1.157			
A634	1.363	-1.595			
A635	1.090	-2.065			
A636	0.828	-1.576			
A637	0.556	-1.107			
A638	0.525	0.646			
A639	0.064●	10.800●			
A640	0.618	-0.211			

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-13, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6.

TABLE 7-15

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.747	-0.025
J102	0.495	-0.802
J103	0.668	-0.933
J104	0.696	-0.868
J105	0.733	-0.201
J106	0.471	-0.666
J107	0.485	-0.025
J108	1.064	-1.641
J109	0.313	-1.025
J110	0.604	-0.465
J111	1.176	-1.148
J112	0.445	-0.677
J113	0.545	-0.940
J114	0.596	0.202
J115	0.787	-0.195
J116	0.345	-1.005
J117	0.326	-0.495
J118	0.565	-0.982
J119	0.598	-0.926
J120	0.299	1.278
J121	0.477	-0.711
J122	0.499	-0.784
J123	0.469	0.258
J124	0.632	-1.481
J125	0.522	-1.487
J126	0.447	-0.528
J127	0.577	-1.397
J128	0.819	-0.855
J129	0.650	1.665
J130	0.357	-1.611
J131	0.843	-0.298
J132	0.398	0.057
J133	0.824	-1.463
J134	0.295	2.172
J135	0.790	-0.091
J136	0.320	0.364
J137	0.613	0.024
J138	0.008●	189.417●
J139	0.381	1.611
J140	0.321	0.325
J141	0.529	-0.869
J142	0.467	0.396
J143	0.661	-0.170
J144	0.382	-0.544
J145	0.665	-0.105
J146	0.757	-0.160
J147	0.512	0.279
J148	0.545	0.319
J149	0.462	-0.097
J150	0.453	0.057
J151	0.554	0.932
J152	0.426	0.574
J153	0.413	1.680
J154	0.364	1.370
J155	0.850	1.046
J156	0.789	1.492

Note: The estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-16, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-16

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of θ Are the Same As Those of θ.

Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.613	0.024
J202	0.008●	189.417●
J203	0.381	1.611
J204	0.321	0.325
J205	0.529	-0.869
J206	0.467	0.396
J207	0.661	-0.170
J208	0.382	-0.544
J209	0.665	-0.105
J210	0.757	-0.160
J211	0.512	0.279
J212	0.545	0.319
J213	0.462	-0.097
J214	0.453	0.057
J215	0.554	0.932
J216	0.426	0.574
J217	0.413	1.680
J218	0.364	1.370
J219	0.850	1.046
J220	0.789	1.492
J221	0.359	1.821
J222	0.589	0.590
J223	0.390	-0.421
J224	0.575	0.576
J225	0.624	-0.025
J226	0.560	0.606
J227	0.563	0.202
J228	0.609	-0.188
J229	0.583	0.135
J230	0.512	0.153
J231	1.310	0.007
J232	0.839	-0.118
J233	0.256	2.127
J234	0.297	1.432
J235	0.855	0.611
J236	0.780	0.730
J237	0.226	-0.048
J238	0.661	2.353
J239	0.424	1.136
J240	0.519	1.726

Item	$\hat{a}_g$	$\hat{b}_g$
J241	1.001	0.006
J242	0.677	0.270
J243	0.330	0.452
J244	0.243	0.965
J245	0.687	1.219
J246	0.220	1.569
J247	0.421	1.127
J248	0.335	-0.679
J249	0.576	1.012
J250	0.589	0.908
J251	0.806	0.258
J252	0.432	1.333
J253	0.475	1.402
J254	0.474	1.353
J255	0.908	1.431
J256	0.422	2.041
J257	0.441	1.022
J258	0.340	1.535
J259	0.649	1.632
J260	0.097●	2.936

Note: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-15, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case J1-J2.

TABLE 7-17

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ.

Item	$\hat{a}_g$	$\hat{b}_g$
A501	0.743	-2.579
A502	0.517	-3.672●
A503	0.590	-3.824●
A504	0.622	-2.302
A505	0.787	-2.672
A506	0.465	-2.285
A507	0.496	-1.051
A508	0.767	-2.061
A509	1.425	-2.186
A510	0.641	-1.047
A511	0.481	-2.426
A512	0.686	-2.153
A513	1.025	-3.093●
A514	0.895	-2.096
A515	0.475	-2.561
A516	0.423	0.577
A517	1.757	-2.607
A518	0.372	-2.778
A519	0.702	-2.193
A520	0.364	-3.501●
A521	0.639	-2.163
A522	0.406	-0.710
A523	0.082●	5.379●
A524	0.435	-2.297
A525	1.001	-2.233
A526	0.877	-0.920
A527	0.089●	-0.428
A528	0.424	-0.078
A529	0.534	-0.616
A530	0.623	-1.954
A531	0.026●	47.687●
A532	0.510	0.071
A533	0.800	-2.018
A534	0.828	-2.398
A535	0.641	-1.472
A536	0.677	-1.248
A537	0.488	-1.503
A538	1.192	-1.067
A539	0.720	-1.130
A540	0.431	-0.757
A541	0.539	-0.988
A542	0.456	-1.613
A543	0.496	-1.241
A544	0.816	-0.531
A545	0.903	-0.720
A546	0.326	0.396
A547	0.292	-0.429
A548	0.482	-0.120

<u>Note</u>: The estimated item parameters for items A533 through A548 are the same as those for items A601 through A616 in Table 7-18, respectively, since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2.

TABLE 7-18

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
A601	0.800	-2.018
A602	0.828	-2.398
A603	0.641	-1.472
A604	0.677	-1.248
A605	0.488	-1.503
A606	1.192	-1.067
A607	0.720	-1.130
A608	0.431	-0.757
A609	0.539	-0.988
A610	0.456	-1.613
A611	0.496	-1.241
A612	0.816	-0.531
A613	0.903	-0.720
A614	0.326	0.396
A615	0.292	-0.429
A616	0.482	-0.120
A617	0.972	-1.683
A618	0.491	-1.293
A619	0.591	-1.266
A620	0.903	-0.615
A621	0.848	-1.011
A622	0.609	-1.787
A623	0.446	-1.581
A624	0.592	-2.319
A625	0.398	-1.960
A626	0.509	-1.084
A627	0.330	-0.456
A628	0.236	-2.945
A629	0.629	-0.650
A630	0.624	-1.075
A631	0.579	-0.881
A632	0.630	-1.535
A633	0.390	-1.242
A634	1.146	-1.762
A635	0.923	-2.313
A636	0.698	-1.739
A637	0.470	-1.183
A638	0.446	0.881
A639	0.058 ●	12.140 ●
A640	0.518	-0.122
A641	0.754	0.049
A642	0.482	-1.007
A643	0.707	-0.850
A644	0.876	-0.595
A645	0.665	-0.206
A646	0.481	-0.661
A647	0.551	0.149
A648	0.984	-1.664
A649	0.362	-0.839
A650	0.615	-0.385
A651	0.981	-1.057
A652	0.395	-0.775
A653	0.577	-0.810
A654	0.550	0.421
A655	0.799	-0.220
A656	0.347	-1.205

Note: The estimated item parameters for items A601 through A616 are the same as those for items A533 through A548 in Table 7-17, respectively since they are overlapping items between Tests A5 and A6 and the results are of Case A5-A6-J1-J2. Also The estimated item parameters for items A641 through A656 are the same as those for J101 through J116 in Table 7-19, respectively, since they are overlapping items between Tests A6 and J1.

TABLE 7-19

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.754	0.049
J102	0.482	-1.007
J103	0.707	-0.850
J104	0.876	-0.595
J105	0.665	-0.206
J106	0.481	-0.661
J107	0.551	0.149
J108	0.984	-1.664
J109	0.362	-0.839
J110	0.615	-0.385
J111	0.981	-1.057
J112	0.395	-0.775
J113	0.577	-0.810
J114	0.550	0.421
J115	0.799	-0.220
J116	0.347	-1.205
J117	0.349	-0.406
J118	0.606	-0.861
J119	0.643	-0.807
J120	0.319	1.250
J121	0.512	-0.606
J122	0.534	-0.677
J123	0.505	0.296
J124	0.678	-1.325
J125	0.561	-1.329
J126	0.480	-0.437
J127	0.619	-1.246
J128	0.877	-0.743
J129	0.698	1.607
J130	0.382	-1.451
J131	0.903	-0.222
J132	0.426	0.108
J133	0.880	-1.314
J134	0.317	2.079
J135	0.848	-0.028
J136	0.343	0.396
J137	0.659	0.077
J138	0.007 ●	199.696 ●
J139	0.410	1.551
J140	0.345	0.356
J141	0.569	-0.753
J142	0.502	0.423
J143	0.711	-0.103
J144	0.412	-0.450
J145	0.716	-0.042
J146	0.817	-0.092
J147	0.550	0.314
J148	0.586	0.352
J149	0.498	-0.033
J150	0.488	0.108
J151	0.596	0.921
J152	0.459	0.588
J153	0.445	1.614
J154	0.392	1.328
J155	0.916	1.028
J156	0.853	1.440

Note: The estimated item parameters for items J101 through J116 are the same as those for items A641 through A656 in Table 7-18, respectively, since they are overlapping items between Tests A6 and J1 and the results are of Case A5-A6-J1-J2. Also the estimated item parameters for items J137 through J156 are the same as those for items J201 through J220 in Table 7-20, respectively, since they are overlapping items between Tests J1 and J2.

TABLE 7-20

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.659	0.077
J202	0.007●	199.696●
J203	0.410	1.551
J204	0.345	0.356
J205	0.569	-0.753
J206	0.502	0.423
J207	0.711	-0.103
J208	0.412	-0.450
J209	0.716	-0.042
J210	0.817	-0.092
J211	0.550	0.314
J212	0.586	0.352
J213	0.498	-0.033
J214	0.488	0.108
J215	0.596	0.921
J216	0.459	0.588
J217	0.445	1.614
J218	0.392	1.328
J219	0.916	1.028
J220	0.853	1.440
J221	0.388	1.741
J222	0.635	0.602
J223	0.422	-0.332
J224	0.622	0.590
J225	0.676	0.036
J226	0.607	0.618
J227	0.608	0.243
J228	0.659	-0.117
J229	0.631	0.183
J230	0.553	0.198
J231	1.416	0.064
J232	0.908	-0.052
J233	0.277	2.023
J234	0.322	1.381
J235	0.926	0.622
J236	0.842	0.732
J237	0.245	0.016
J238	0.714	2.234
J239	0.457	1.108
J240	0.560	1.653
J241	1.086	0.065
J242	0.731	0.307
J243	0.356	0.473
J244	0.262	0.949
J245	0.742	1.184
J246	0.237	1.509
J247	0.455	1.100
J248	0.362	-0.572
J249	0.620	0.993
J250	0.637	0.897
J251	0.872	0.296
J252	0.468	1.290
J253	0.514	1.354
J254	0.513	1.309
J255	0.980	1.381
J256	0.456	1.945
J257	0.477	1.002
J258	0.368	1.477
J259	0.701	1.566
J260	0.103	2.789

<u>Note</u>: The estimated item parameters for items J210 through J220 are the same as those for items J137 through J156 in Table 7-19, respectively, since they are overlapping items between Tests J1 and J2 and the results are of Case A5-A6-J1-J2.

TABLE 7-21

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.773	-0.051
J102	0.514	-0.796
J103	0.695	-0.923
J104	0.723	-0.860
J105	0.764	-0.218
J106	0.491	-0.664
J107	0.505	-0.048
J108	1.114	-1.596
J109	0.327	-1.004
J110	0.634	-0.468
J111	1.228	-1.127
J112	0.460	-0.679
J113	0.564	-0.933
J114	0.619	0.170
J115	0.822	-0.212
J116	0.357	-0.997
J117	0.339	-0.501
J118	0.585	-0.974
J119	0.621	-0.917
J120	0.310	1.208
J121	0.498	-0.705
J122	0.519	-0.779
J123	0.488	0.224
J124	0.659	-1.446
J125	0.546	-1.448
J126	0.465	-0.532
J127	0.599	-1.369
J128	0.854	-0.847
J129	0.674	1.581
J130	0.373	-1.567
J131	0.879	-0.312
J132	0.412	0.030
J133	0.868	-1.420
J134	0.303	2.084
J135	0.824	-0.113
J136	0.333	0.327
J137	0.638	0.098
J138	---	---
J139	0.418	1.315
J140	0.386	0.273
J141	0.592	-0.830
J142	0.465	0.402
J143	0.687	-0.182
J144	0.364	-0.468
J145	0.754	-0.262
J146	0.840	-0.067
J147	0.458	0.272
J148	0.492	0.408
J149	0.494	-0.189
J150	0.488	-0.077
J151	0.452	0.952
J152	0.358	0.611
J153	0.462	1.476
J154	0.228	2.044
J155	0.845	1.043
J156	0.723	1.427

TABLE 7-22

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J101	1.013	0.293	0.146
J102	0.540	-0.483	0.143
J103	0.722	-0.663	0.143
J104	0.784	-0.579	0.143
J105	0.949	0.105	0.137
J106	0.550	-0.271	0.143
J107	0.623	0.346	0.143
J108	0.930	-1.734	0.143
J109	0.351	-0.504	0.143
J110	0.717	-0.130	0.143
J111	1.181	-1.022	0.143
J112	0.494	-0.302	0.143
J113	0.582	-0.646	0.143
J114	1.180	0.734	0.234
J115	1.088	0.178	0.173
J116	0.387	-0.533	0.143
J117	0.377	0.019	0.143
J118	0.588	-0.711	0.143
J119	0.649	-0.640	0.143
J120	1.107	1.714	0.278
J121	0.536	-0.345	0.143
J122	0.552	-0.438	0.143
J123	0.640	0.625	0.143
J124	0.624	-1.324	0.143
J125	0.537	-1.255	0.143
J126	0.522	-0.122	0.143
J127	0.583	-1.199	0.143
J128	0.886	-0.619	0.143
J129	0.827	1.496	0.018
J130	0.370	-1.240	0.143
J131	1.218	0.105	0.191
J132	0.509	0.497	0.143
J133	0.835	-1.316	0.143
J134	0.645	2.154	0.162
J135	0.847	-0.003	0.041
J136	0.416	0.848	0.143
J137	0.824	0.429	0.131
J138	---	---	---
J139	1.225	1.590	0.213
J140	0.606	0.965	0.218
J141	0.612	-0.543	0.143
J142	0.940	1.035	0.245
J143	1.012	0.306	0.201
J144	0.414	0.028	0.143
J145	0.829	-0.026	0.103
J146	0.966	0.145	0.087
J147	1.586	1.135	0.338
J148	0.821	0.954	0.207
J149	0.587	0.218	0.143
J150	0.577	0.332	0.143
J151	0.816	1.354	0.181
J152	1.277	1.470	0.331
J153	1.148	1.607	0.167
J154	0.702	2.350	0.249
J155	1.623	1.126	0.089
J156	1.462	1.409	0.086

TABLE 7-23

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.764	-0.219
J102	0.549	-0.908
J103	0.622	-1.146
J104	0.769	-0.748
J105	0.848	-0.085
J106	0.513	-0.686
J107	0.589	0.211
J108	0.978	-1.708
J109	0.386	-0.824
J110	0.591	-0.302
J111	1.155	-1.140
J112	0.439	-0.999
J113	0.528	-1.003
J114	0.488	0.471
J115	0.746	-0.212
J116	0.303	-1.598
J117	0.397	-0.574
J118	0.660	-1.413
J119	0.704	-0.904
J120	0.293	1.015
J121	0.502	-0.811
J122	0.472	-0.961
J123	0.461	0.150
J124	0.621	-1.183
J125	0.489	-1.527
J126	0.375	-0.375
J127	0.574	-1.180
J128	0.757	-1.002
J129	0.757	1.434
J130	0.389	-1.605
J131	0.862	-0.465
J132	0.332	0.186
J133	0.960	-1.245
J134	0.298	1.581
J135	0.917	-0.212
J136	0.362	0.280
J137	0.606	0.320
J138	---	---
J139	0.397	1.484
J140	0.415	0.219

Item	$\hat{a}_g$	$\hat{b}_g$
J141	0.583	-0.658
J142	0.463	0.136
J143	0.617	-0.087
J144	0.376	-0.397
J145	0.651	-0.464
J146	0.928	0.049
J147	0.362	0.363
J148	0.521	-0.063
J149	0.500	-0.102
J150	0.537	-0.032
J151	0.470	0.857
J152	0.400	0.447
J153	0.432	1.833
J154	0.254	2.132
J155	0.792	1.218
J156	0.738	1.381

TABLE 7-24

Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 55 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model. After the Scale Adjustment Assuming That the Mean and Standard Deviation of $\hat{\theta}$ Are the Same As Those of θ .

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J101	0.949	0.098	0.151
J102	0.571	-0.637	0.146
J103	0.639	-0.913	0.146
J104	0.842	-0.493	0.146
J105	1.026	0.139	0.109
J106	0.565	-0.337	0.146
J107	0.726	0.466	0.109
J108	0.849	-1.821	0.146
J109	0.421	-0.393	0.146
J110	0.706	0.053	0.146
J111	1.114	-1.059	0.146
J112	0.457	-0.660	0.146
J113	0.551	-0.712	0.146
J114	0.996	1.044	0.245
J115	0.946	0.154	0.172
J116	0.321	-1.102	0.146
J117	0.441	-0.135	0.146
J118	0.629	-1.300	0.146
J119	0.743	-0.662	0.146
J120	0.566	1.667	0.229
J121	0.531	-0.490	0.146
J122	0.492	-0.636	0.146
J123	0.577	0.554	0.146
J124	0.620	-0.977	0.146
J125	0.487	-1.307	0.146
J126	0.430	0.102	0.146
J127	0.575	-0.968	0.146
J128	0.765	-0.818	0.146
J129	0.877	1.367	0.013
J130	0.385	-1.316	0.146
J131	1.054	-0.127	0.178
J132	0.409	0.713	0.146
J133	0.960	-1.119	0.146
J134	0.456	1.928	0.146
J135	1.003	-0.051	0.085
J136	0.456	0.758	0.146
J137	0.762	0.566	0.108
J138	---	---	---
J139	0.997	1.661	0.193
J140	0.527	0.656	0.146

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J141	0.623	-0.357	0.146
J142	0.847	0.857	0.267
J143	0.908	0.410	0.209
J144	0.422	0.067	0.146
J145	0.721	-0.164	0.146
J146	1.144	0.253	0.101
J147	1.558	1.328	0.373
J148	0.632	0.316	0.146
J149	0.594	0.280	0.146
J150	0.654	0.338	0.146
J151	0.810	1.247	0.182
J152	1.018	1.252	0.308
J153	1.311	1.682	0.156
J154	0.671	2.256	0.212
J155	1.492	1.223	0.085
J156	1.575	1.346	0.095

standard deviation of each, separate distribution of $\hat{\theta}$, respectively.

Close observation of the first and third graph of Figure 7-7 suggests that this assumption of equality of the mean and standard deviation of the distribution of θ and those of the distribution of in each examinee group may not be appropriate. We can see in these two graphs that those item parameter estimates obtained by Logist 5 assuming (two-parameter) logistic model tend to be higher in discrimination indices and tend to be regressed to center in difficulty indices compared with the corresponding estimates obtained by the Tetrachoric Method. This fact suggests that the distribution of $\hat{\theta}$ obtained by Logist 5 has a larger standard deviation than that of θ for these two examinee groups.

If the assumption that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ equal those of the distribution of θ in each combined examinee group, then the line specified by

$$(7.1) \qquad \hat{\sigma}_u \hat{a}_{(L)} = \hat{\sigma}_c \hat{a}_{(T)} ,$$

where $\hat{\sigma}_c$ and $\hat{\sigma}_u$ are the estimated standard deviations of the distribution of θ of a specified combined group and of an uncombined group which is a part of the combined group, respectively, and $\hat{a}_{(T)}$ and $\hat{a}_{(L)}$ represent the axes of estimated item discrimination parameters by Tetrachoric Method and by Logist 5, respectively, will

fit the corresponding scatter diagram of the two sets of unadjusted estimated discrimination parameters. The corresponding formula for the scatter diagram of the two sets of estimated difficulty parameters before any scale adjustment is

$$(7.2) \qquad \hat{\sigma}_c \hat{b}_{(L)} + \hat{\mu}_c = \hat{\sigma}_u \hat{b}_{(T)} + \hat{\mu}_u ,$$

where $\hat{\sigma}_c$ and $\hat{\sigma}_u$ are as described earlier, $\hat{\mu}_c$ and $\hat{\mu}_u$ are the estimated means of the combined group and of the uncombined group, respectively, and $\hat{b}_{(T)}$ and $\hat{b}_{(L)}$ represent the axes of estimated item difficulty parameters by Tetrachoric Method and by Logist 5, respectively.

The linear relationship specified by (7.1) for the estimated discrimination parameters is drawn by a long dashed line in each graph of Figure 7-1, which includes the two combined groups, i.e., Cases A5-A6 and J1-J2. We can see that the line does not fit to the scatter diagram very well in each of the first three graphs of Figure 7-1, while it does a little better in the other two. The corresponding linear relationship specified by (7.2) for the estimated difficulty parameters is also shown by a long dashed line in each graph of Figure 7-2. The fit of these lines to the corresponding scatter diagrams appears to be fairly good this time, but not to the extent to make us feel unnecessary to search for better linear relationships for these scatter diagrams of estimated difficulty parameters.

Corresponding two sets of linear relationships for the scatter

diagrams of the "unadjusted" item discrimination and difficulty parameters were obtained with respect to Case A5-A6-J1-J2 by using formulae (7.1) and (7.2), and they are shown by long dashed lines in Figures 7-3 and 7-4. We can see that, in these cases, too, the linear relationships do not fit the corresponding scatter diagrams very well.

The same procedure was taken for each of the scatter diagrams of the estimated item discrimination parameters, and of the estimated difficulty parameters, which concern with Case J1/1075: c_g-Zero and with Case J1/2259: c_g-Zero. These resulting linear relationships are drawn by long dashed lines in the corresponding graphs of Figures 7-5 and 7-6. In these results, there is a systematic tendency that for the scatter diagrams of estimated item discrimination parameters these long dashed lines are too steep, and for those of estimated item difficulty parameters the lines are too flat. This fact indicates that both standard deviations of the distribution of $\hat{\theta}$ in Case J1/1075: c_g-Zero and in Case J1/2259: c_g-Zero are larger than the standard deviations of the corresponding distributions of θ. Note that this finding is consistent with the observation made earlier for the first and the third graphs of Figure 7-7. For comparison, the same linear relationship obtained for c_g-Zero is also shown by a long dashed line in the corresponding graph for c_g-Free for each of Cases J1/1075 and J1/2259. We can see that these lines are much farther apart from the corresponding scatter diagrams.

Since the linear relationships specified by (7.1) and (7.2) failed in fitting the corresponding scatter diagrams in many cases,

the iterative method of finding the best fitted lines for both the estimated item discrimination and difficulty parameters, which was introduced and applied for the overlapping test items in Section 6, was also adopted for the present results. Table 7-25 presents the slope and intercept of each of the resulting linear relationships. As before, certain items were excluded in the process of obtaining the best fitted linear relationships since one, or both, of the two estimated difficulty parameters exceeds 2.0 in absolute value. There are 5 items of Test A5 excluded from the first scatter diagrams of Figures 7-1 and 7-2, 6 items of Test A6 from the second scatter diagrams of these two figures, 2 items of Test J1 from the third ones, 4 items of Test J1 from the fourth ones, and 2 items of Test J2 from the fifth ones; there are 9 items of Test A5 excluded from the first scatter diagrams of Figures 7-3 and 7-4, 6 items of Test A6 from the second scatter diagrams of these two figures, 4 items of Test J1 from the third ones, and 2 items of Test J2 from the fourth ones; and there is 1 item of Test J1 excluded from the first scatter diagrams of Figures 7-5 and 7-6, 4 items of Test J1 from the third scatter diagrams of these two figures, 3 items of Test J1 from the fifth ones, and 4 items of Test J1 from the seventh ones. These items are circled in the scatter diagrams of Figures 7-1 through 7-6, unless they are not seen in these figures because of their too extremely deviated estimate values. The linear relationship thus obtained is drawn by a thin, solid line in each graph of Figures 7-1 through 7-4, and in each graph of Figures 7-5 and 7-6 where (two-parameter) logistic model is

TABLE 7-25

Slope And Intercept of Each of the Fitted Linear Relationship between the Two Sets of Estimated Discrimination Parameters, And Also Those of Estimated Difficulty Parameters, of the Common Test Items, Which Were Obtained by the Tetrachoric Method (Examinee Group 1) And by Logist 5 (Examinee Group 2), before Any Scale Adjustment.

Examinee Group 1	Examinee Group 2	a_g		Combined	b_g		Combined	
		Slope	Intercept	Slope	Slope	Intercept	Slope	Intercept
A5/0599	A5-A6	1.222	-0.013	1.214	0.829	-0.267	0.823	-0.270
A6/0412	A5-A6	1.034	-0.008	1.048	0.941	0.331	0.954	0.338
J1/0614	A5-A6	1.012*	-0.018*	0.897*	1.257*	0.937*	1.115*	0.841*
J1/0614	J1-J2	1.339	-0.009	1.377	0.707	-0.572	0.726	-0.566
J2/0758	J1-J2	1.083	-0.012	1.121	0.861	0.446	0.892	0.462
A5/0599	A5-A6-J1-J2	1.567	-0.018	1.555	0.648	-0.921	0.643	-0.923
A6/0412	A5-A6-J1-J2	1.387	-0.009	1.427	0.681	-0.470	0.701	-0.458
J1/0614	A5-A6-J1-J2	1.479	-0.006	1.522	0.638	-0.118	0.657	-0.112
J2/0758	A5-A6-J1-J2	1.234	-0.014	1.277	0.757	0.783	0.783	0.796
J1/1075	J1/1075	1.102	-0.006	1.107	0.899	-0.015	0.903	-0.013
J1/0614	J1/1075	1.162	-0.009	1.202	0.804	-0.256	0.832	-0.247
J1/2259	J1/2259	1.068	-0.005	1.069	0.935	-0.007	0.936	-0.007
J1/0614	J1/2259	1.069	-0.00[illegible]	1.081	0.915	-0.284	0.925	-0.281

* This is based on only 14 items while all the other results are based on at least 36 items.

assumed in using Logist 5. As before, the two sets of results obtained for the scatter diagram of the estimated item discrimination parameters and for that of the estimated item difficulty parameters were combined in each case, and the result is shown by a thick, solid line in each graph. Again, in the last two figures, for comparison, the same pair of solid lines are drawn in each corresponding graph for the results of the three-parameter logistic model.

VIII. Scale Adjustment II

For the purpose of better visualizing the discrepancies in the mean and standard deviation between the distribution of θ and that of $\hat{\theta}$ for each examinee group, the rescaled item parameters of the items of Tests A5, A6, J1 and J2, which were obtained originally by Logist 5 and shown in Tables 7-13 through 7-24, were plotted against the corresponding rescaled item parameters obtained originally by Tetrachoric Method, which are shown in Tables 6-4 through 6-9. They were paired, arranged and categorized in the same way as we did for the unadjusted parameter estimates in Figures 7-1 through 7-6, and presented as Figures 8-1 through 8-6. We notice that, if the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of θ in each examinee group, then the line passing through the origin, $(0,0)$, and converging the abscissa with the angle of 45 degrees will be the best fitting linear relationship in each graph of these figures, except for the situations which concern three-parameter logistic model assumed in using Logist 5.

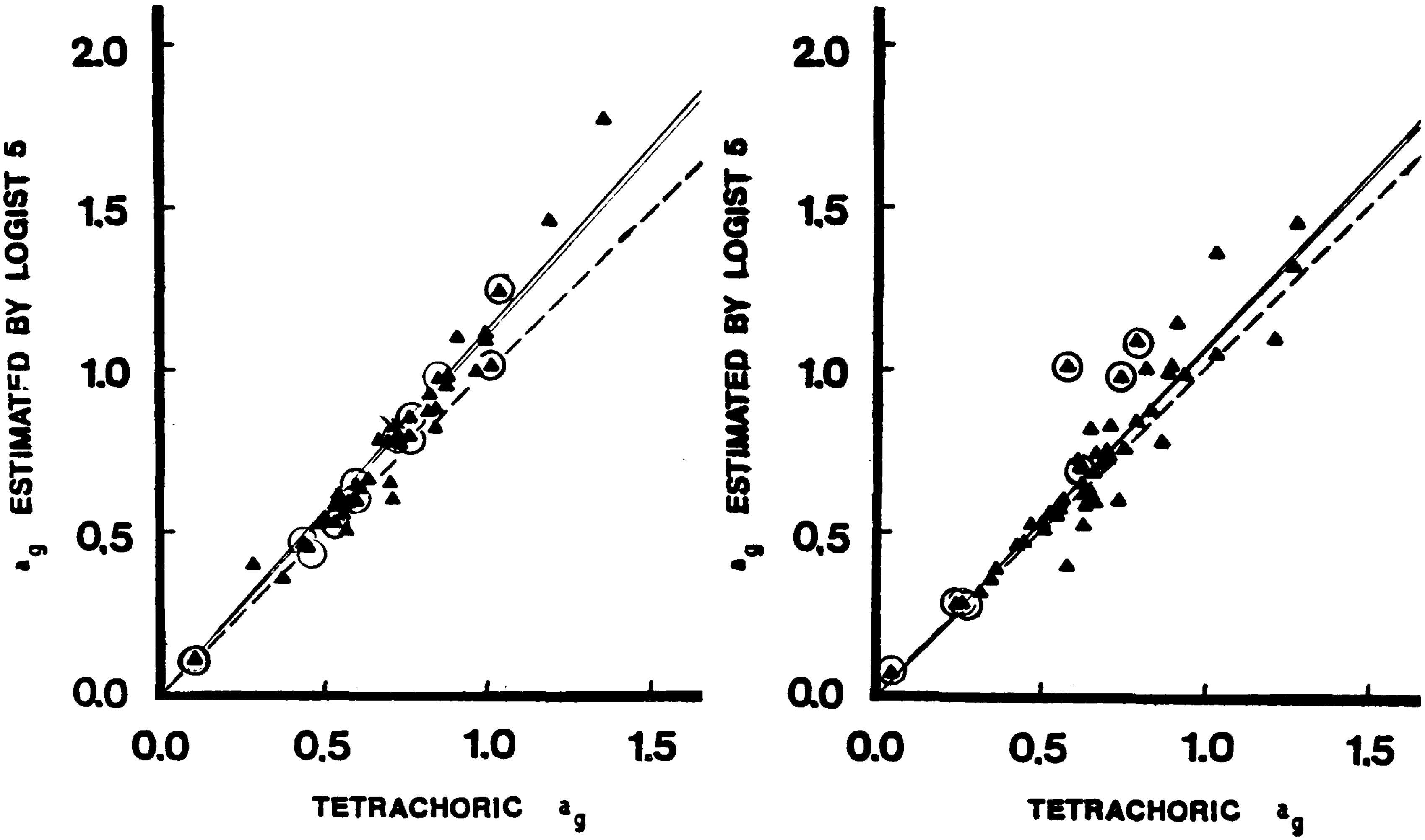


FIGURE 8-1

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa and upon the Case A5-A6 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6 on the Ordinate.

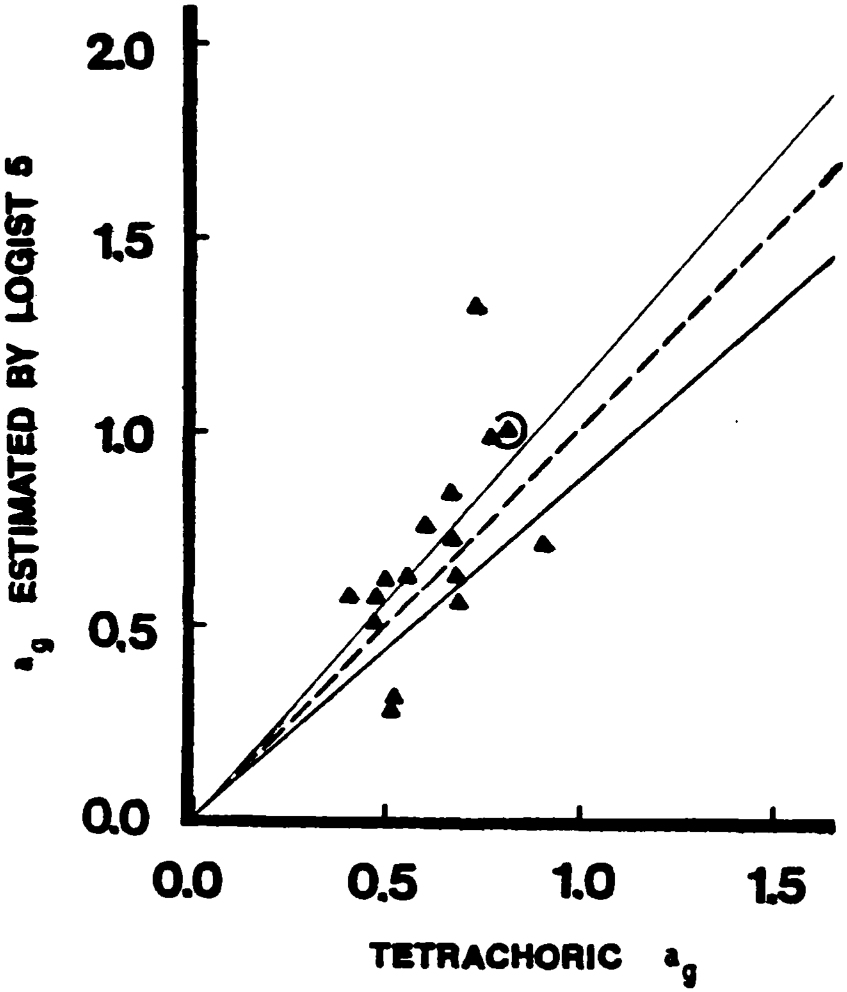
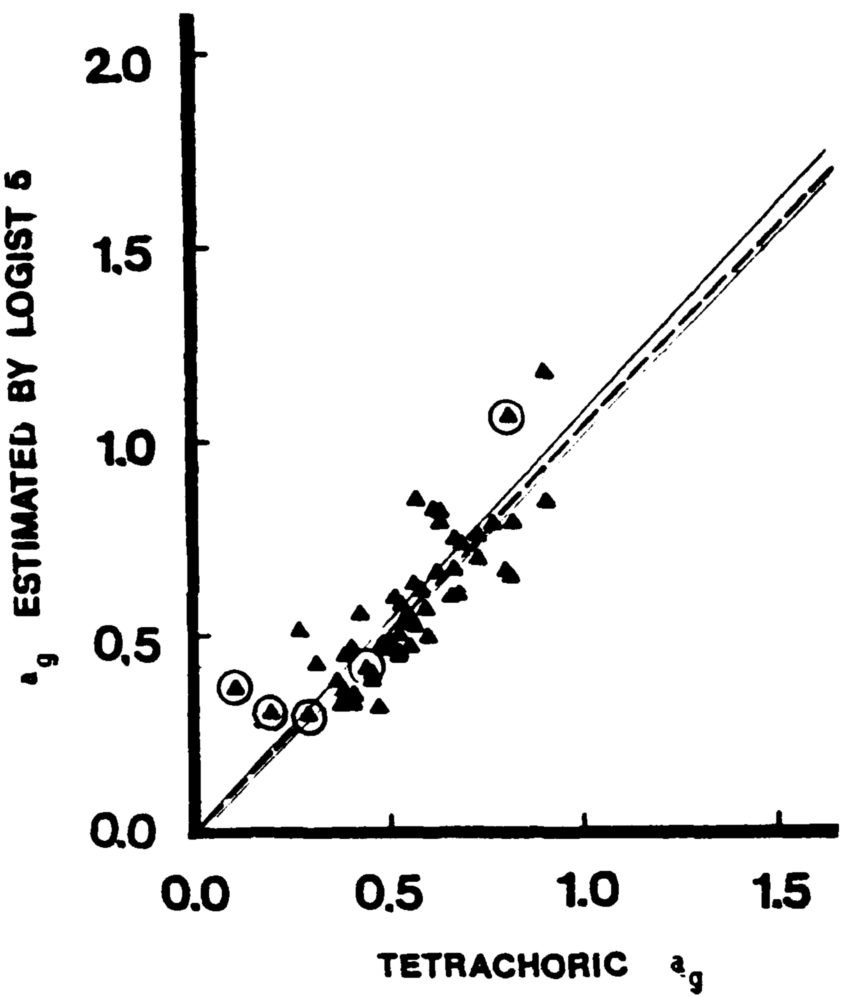


FIGURE 8-1 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.



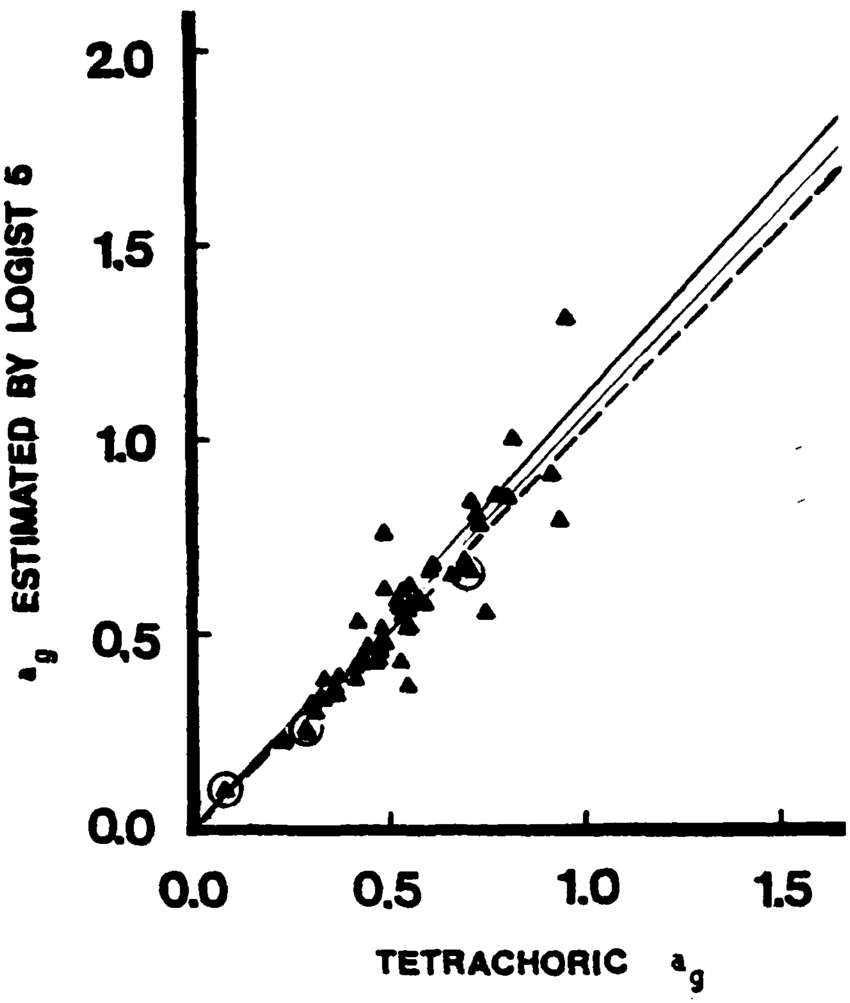


FIGURE 8-1 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

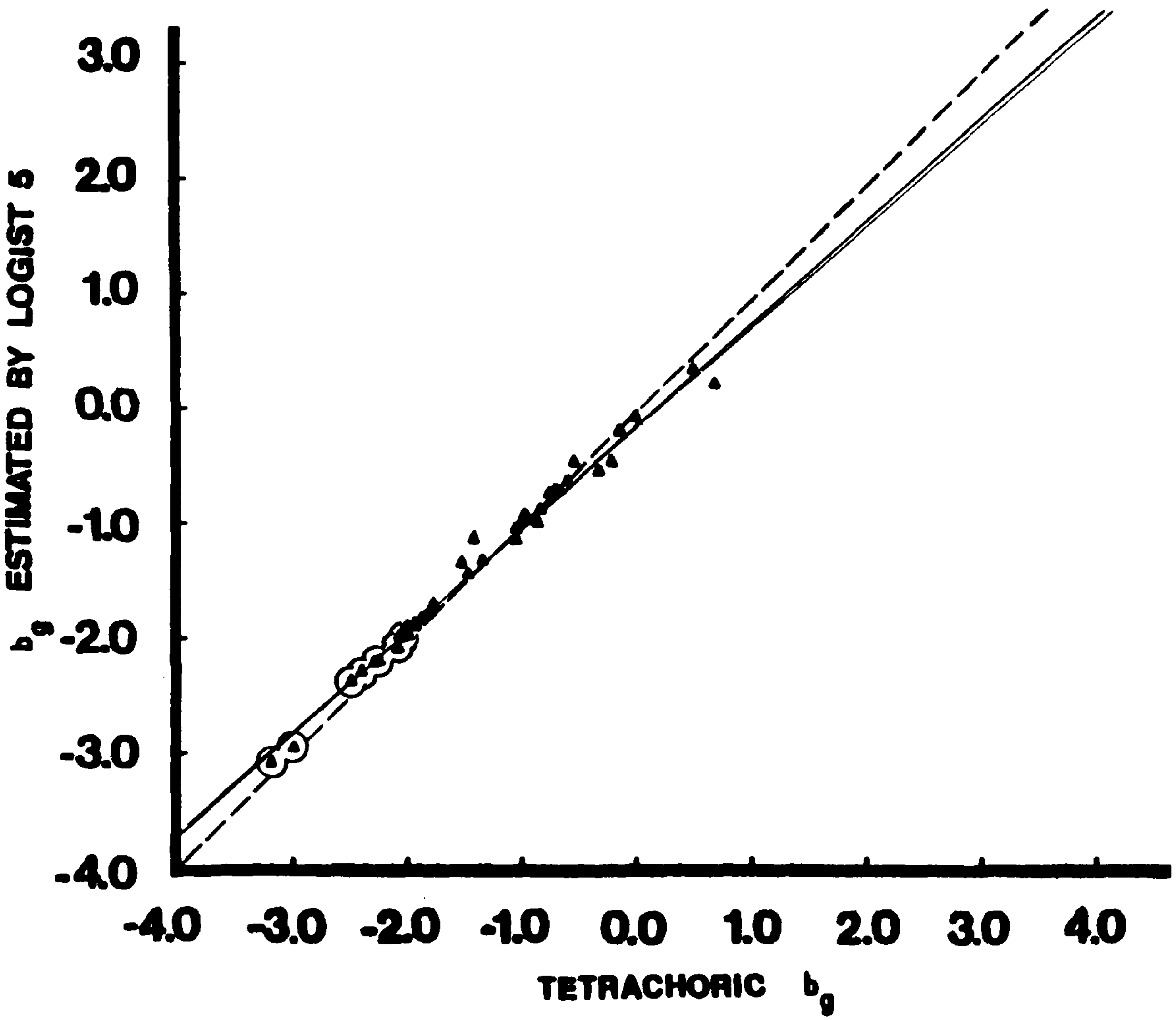


FIGURE 8-2

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Solid, Thin Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. For the 43 Items of Test A5 Excluding Items A523 And A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

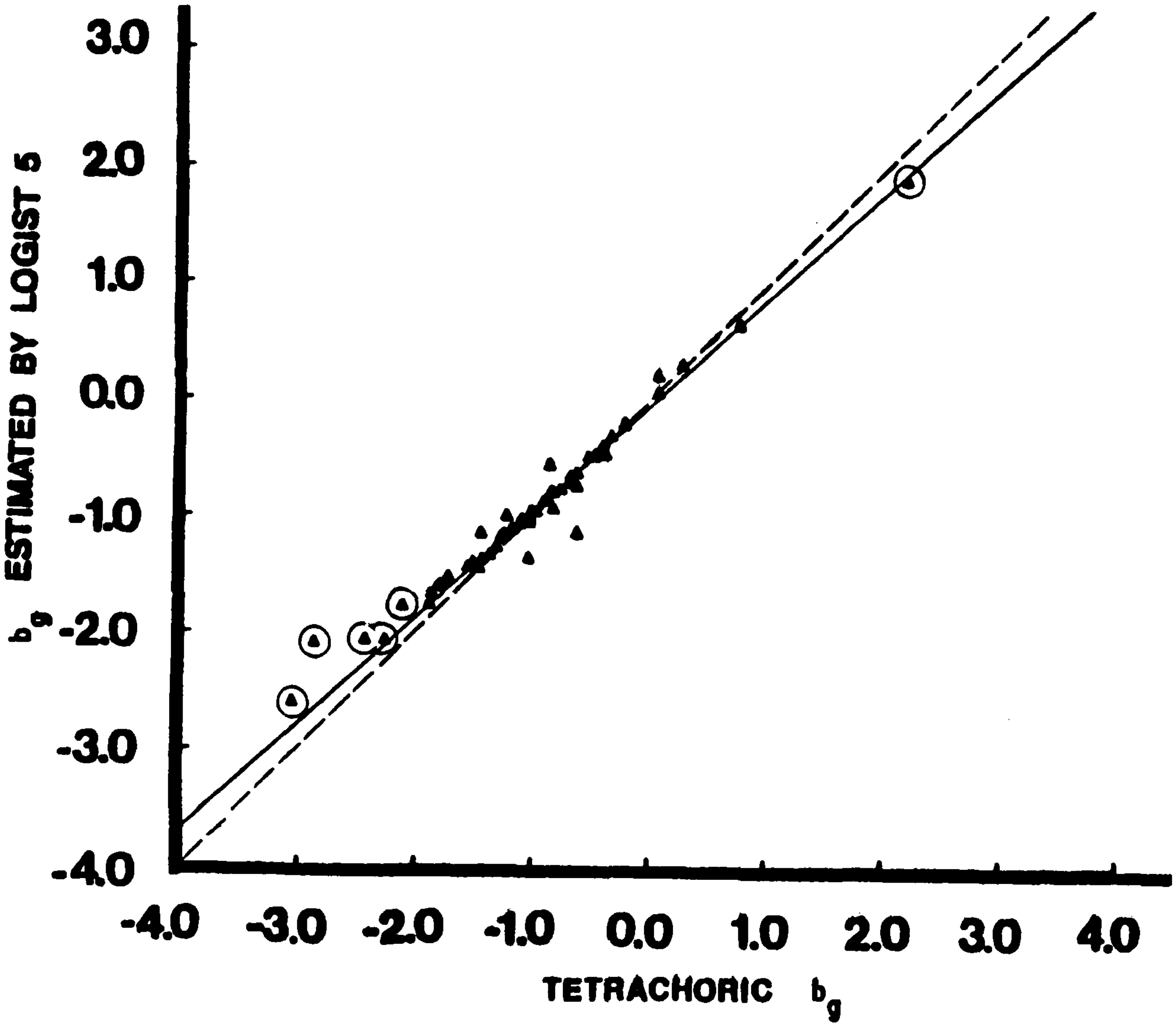


FIGURE 8-2 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

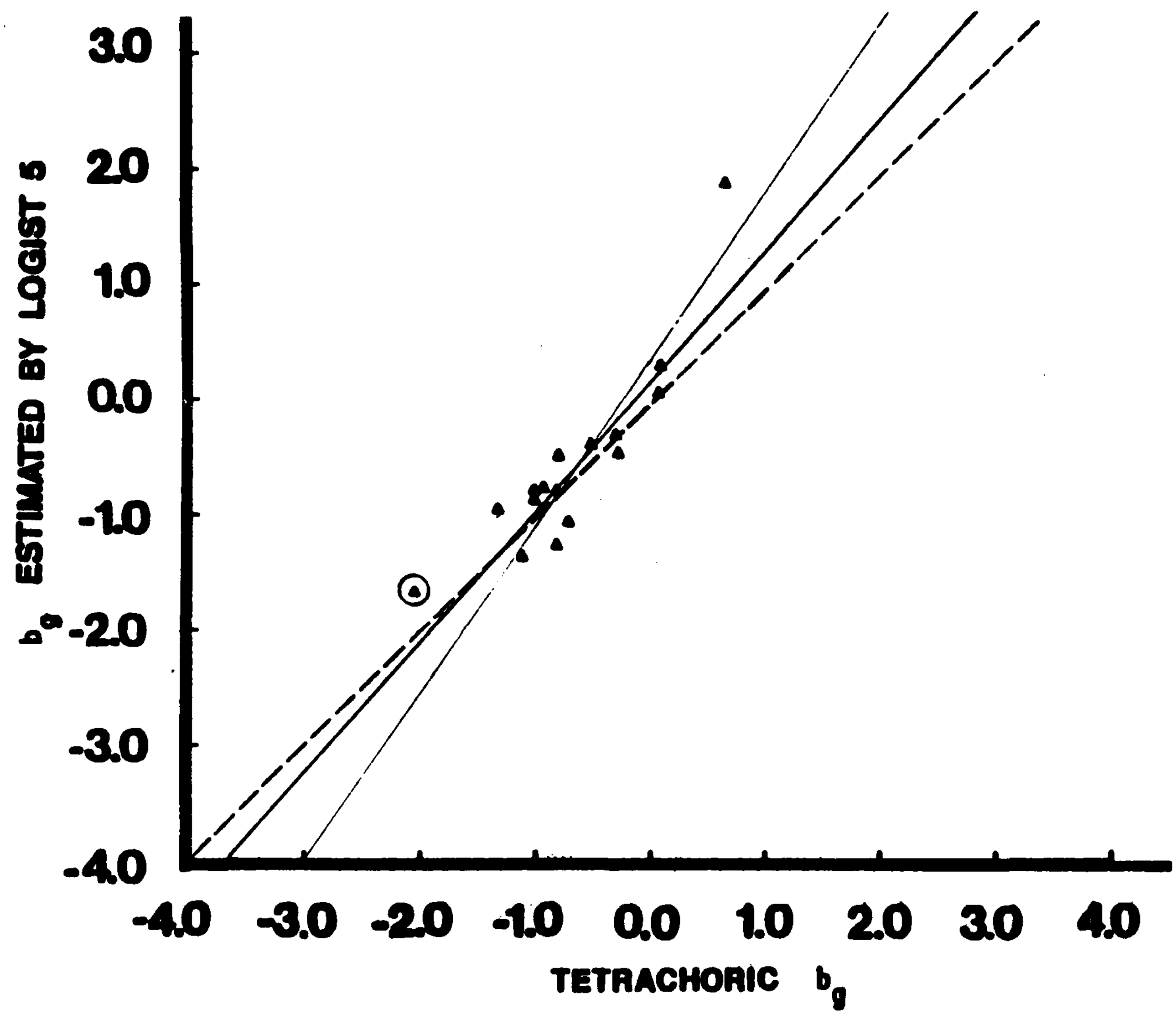


FIGURE 8-2 (Continued)

For the 16 Items Overlapping in Tests A6 And J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6 on the Ordinate.

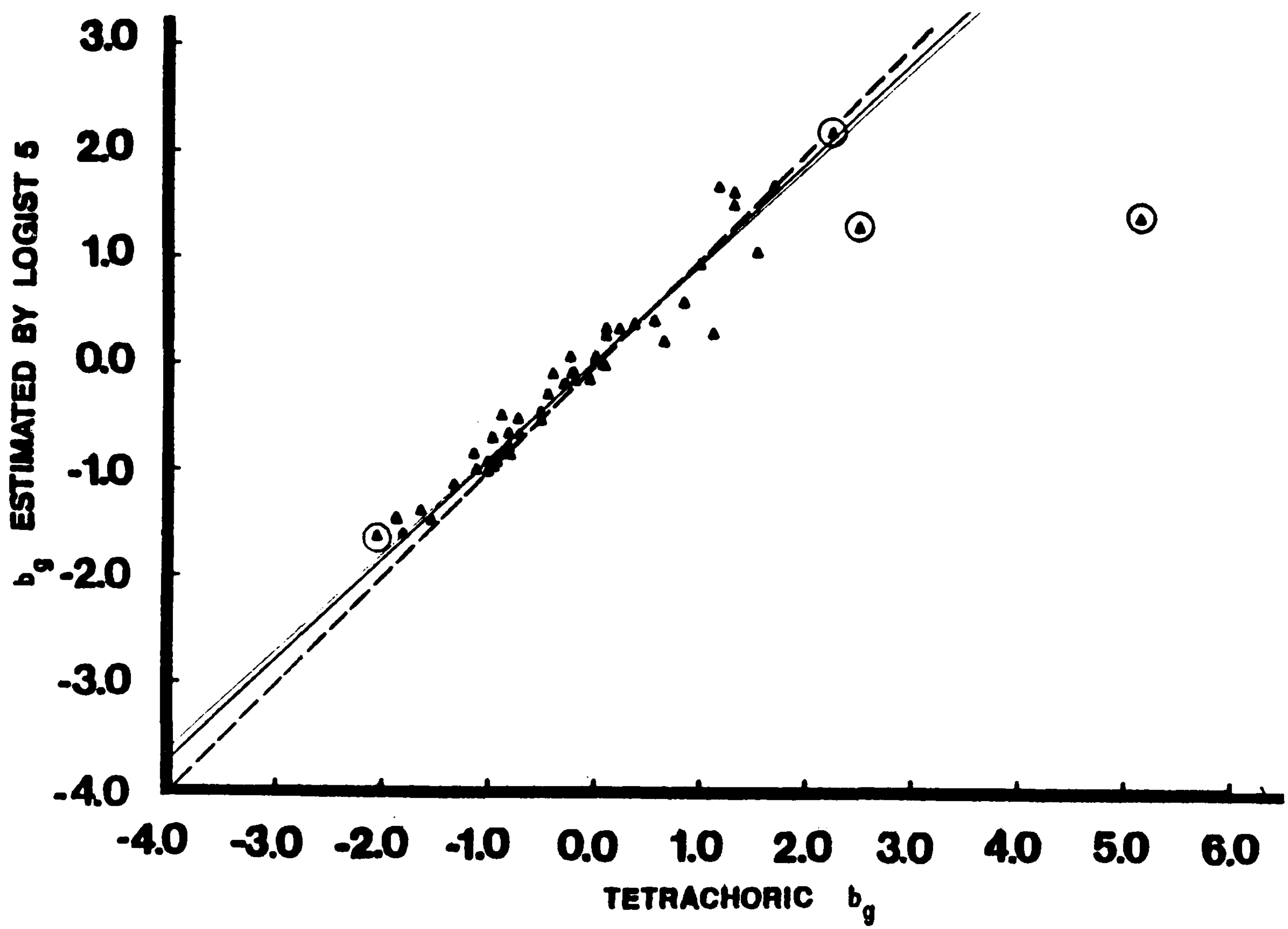


FIGURE 8-2 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.

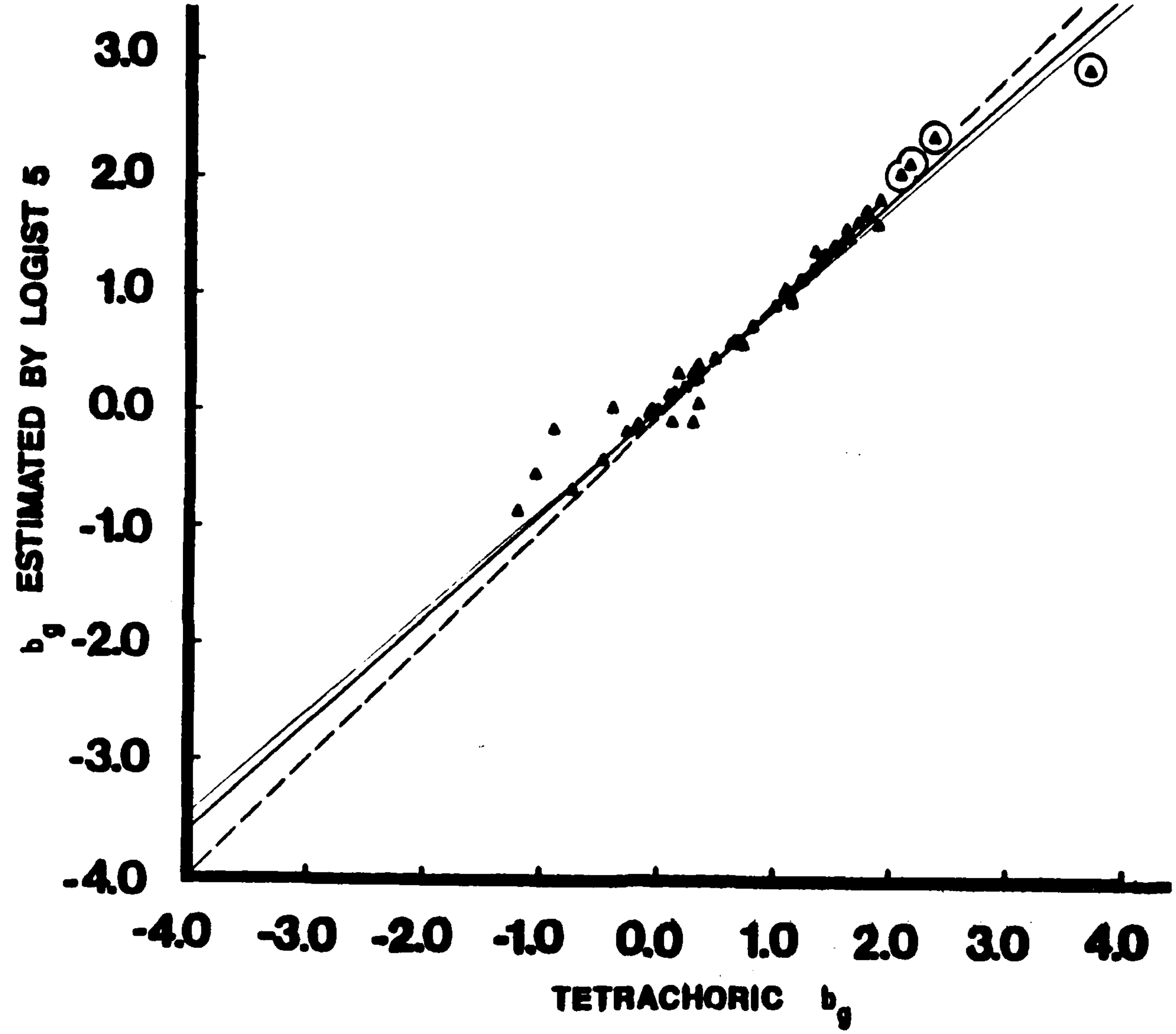
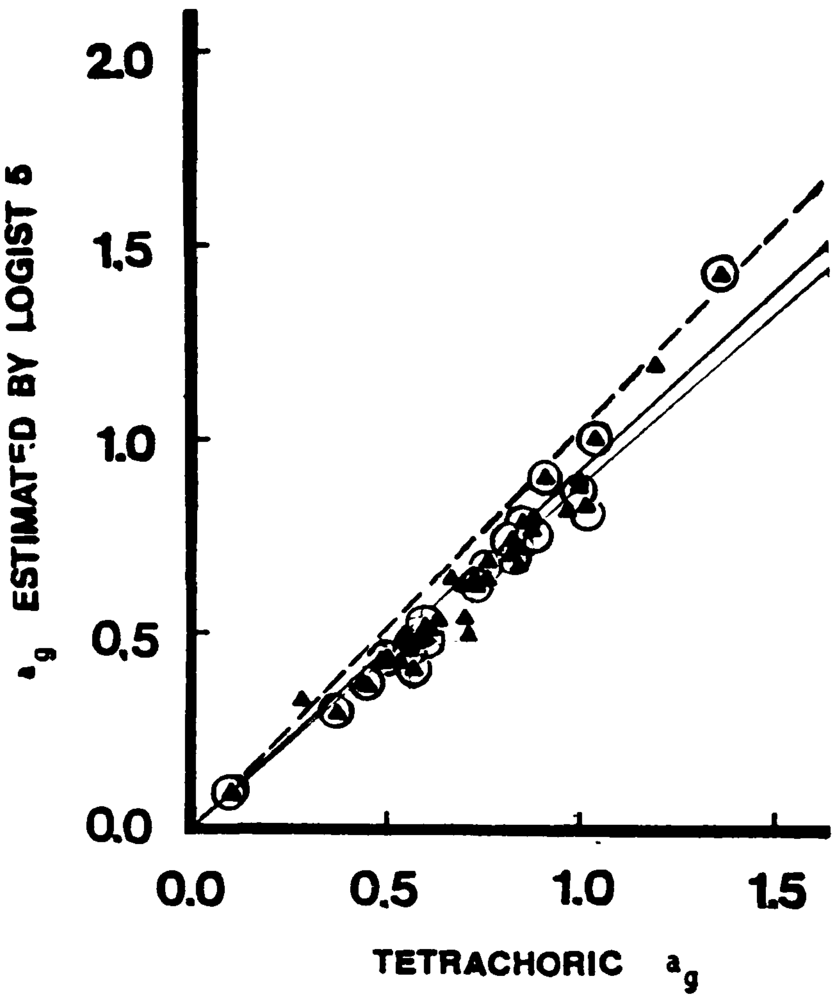


FIGURE 8-2 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case J1-J2 on the Ordinate.



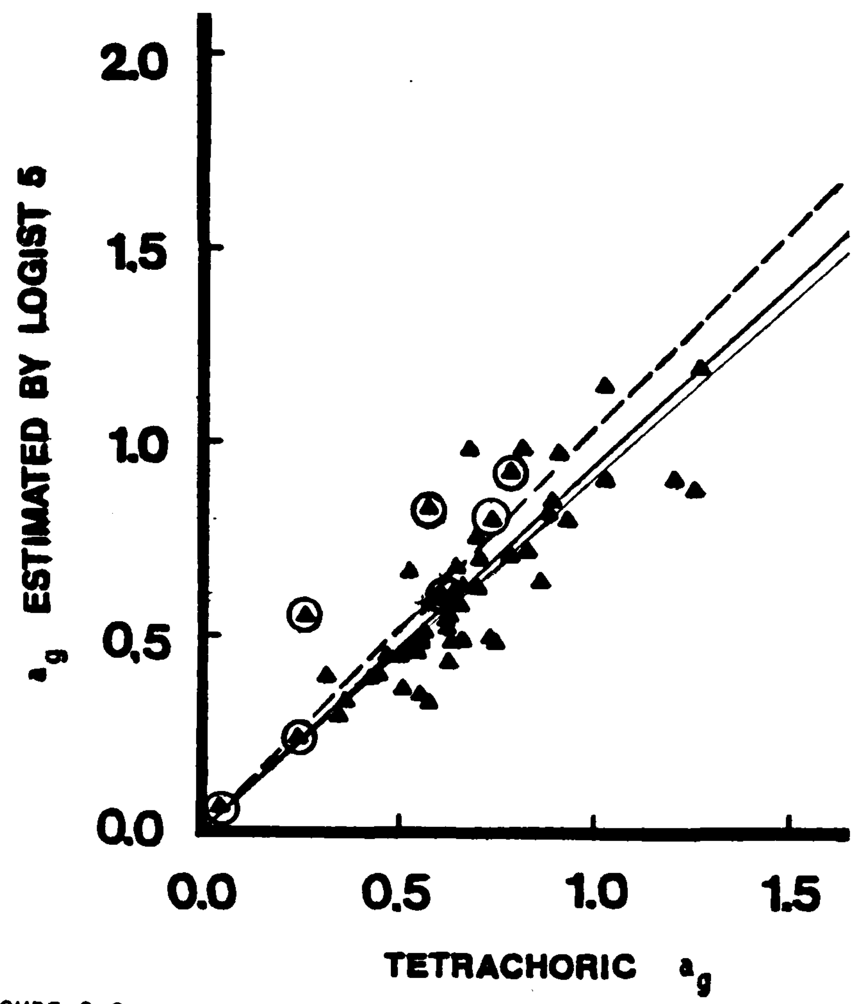
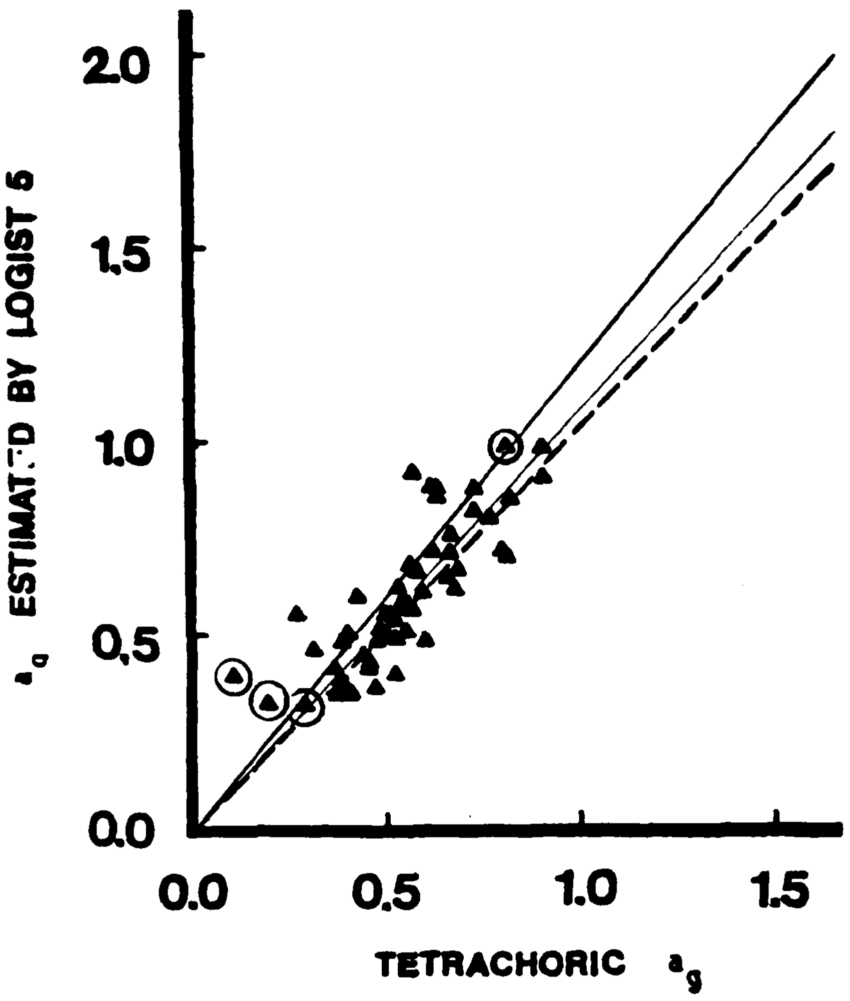


FIGURE 8-3

Estimated Item Discrimination Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed. The Best Fitted Linear Relationship Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. The Graph on the Left Hand Side Is for the 44 Items of Test A5 Excluding Item A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate, While the Graph on the Right Hand Side Is for the 56 Items of Test A6 Based upon the A6/0412 Case on the Abscissa and upon the Case A5-A6-J1-J2 on the Ordinate.



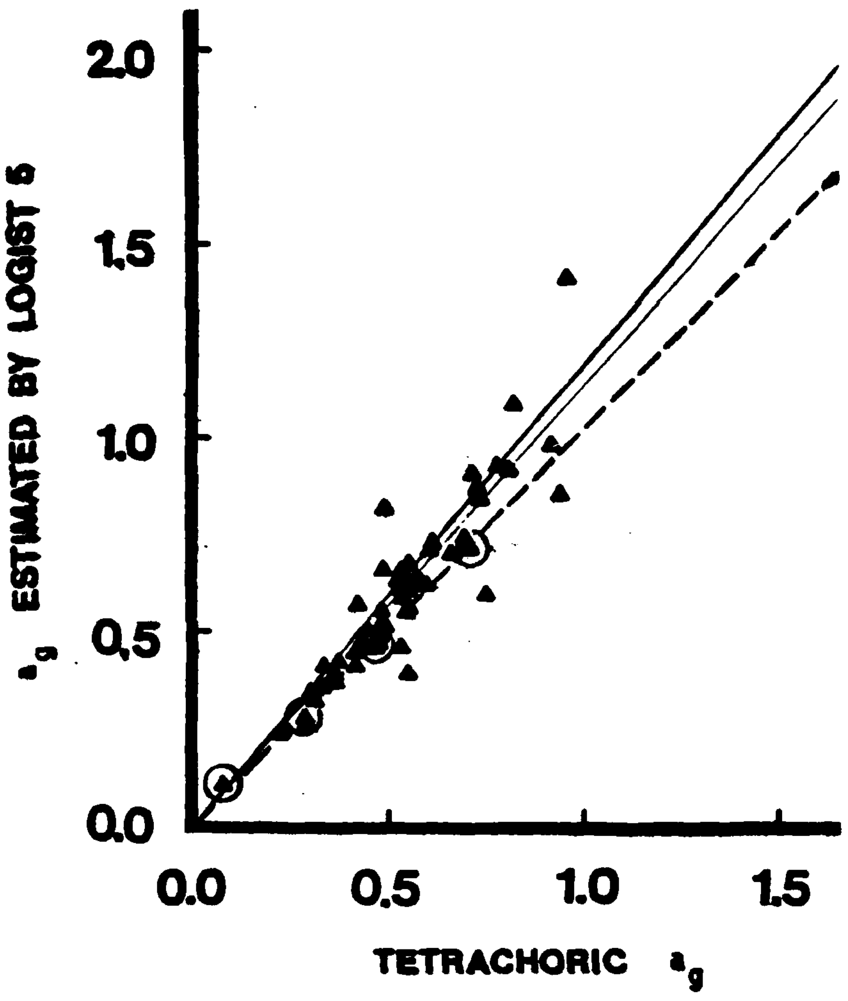


FIGURE 8-3 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

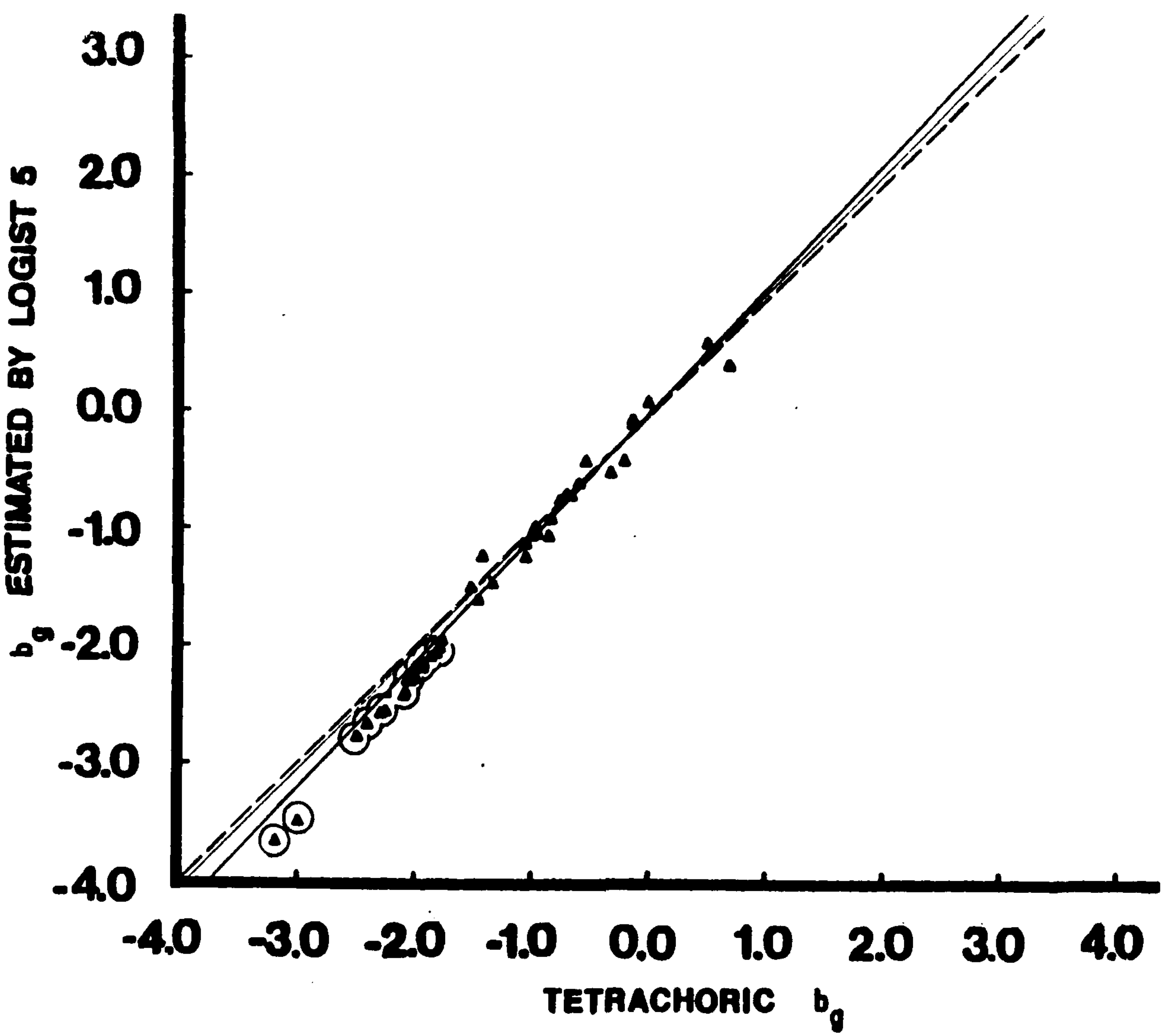


FIGURE 8-4

Estimated Item Difficulty Parameters Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Guessing Parameter c_g Is Set Equal to Zero, i.e., Logistic Model Is Assumed.

For the 43 Items of Test A5 Excluding Items A523 and A531 Based upon the A5/0599 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

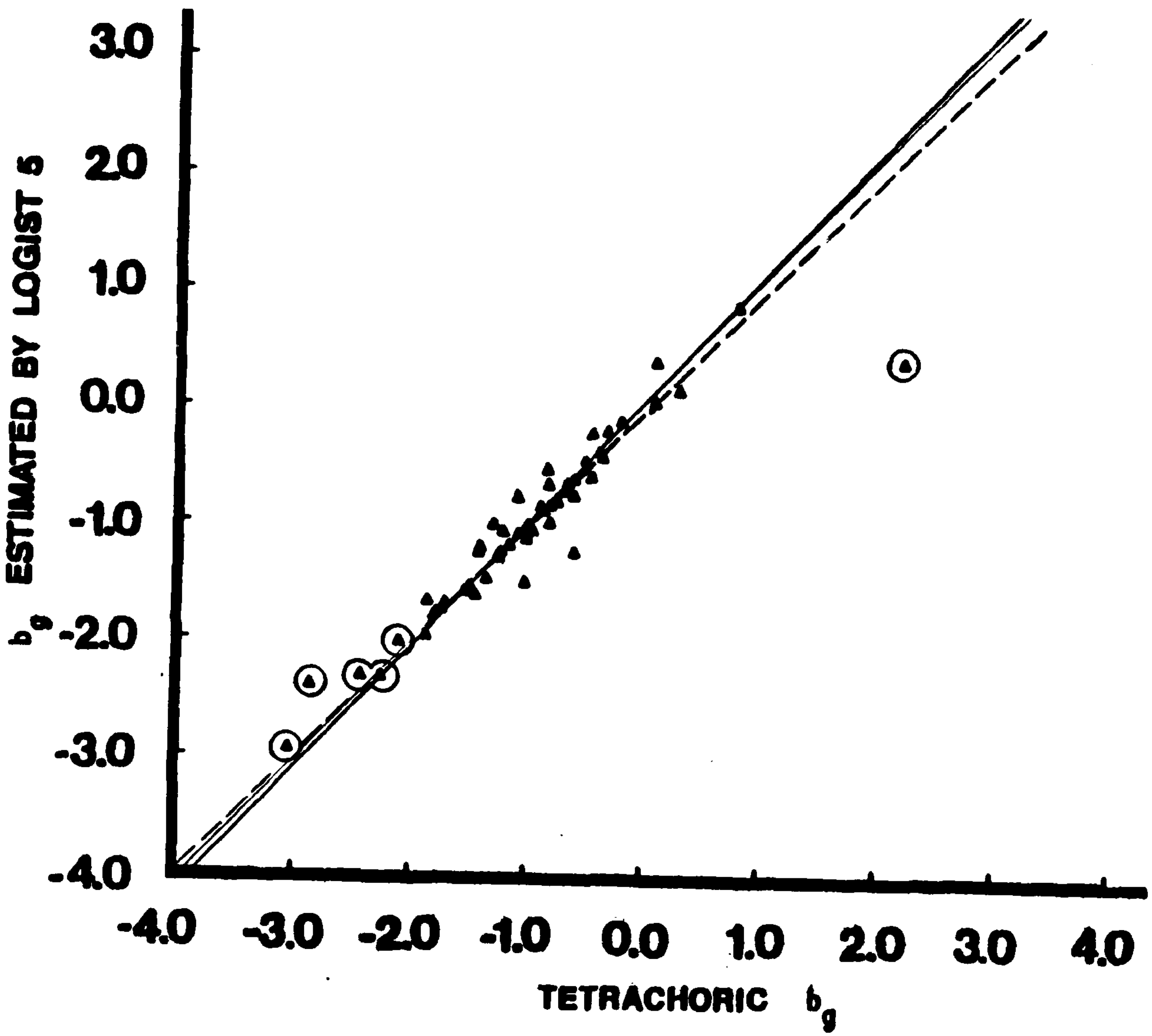


FIGURE 8-4 (Continued)

For the 55 Items of Test A6 Excluding Item A639 Based upon the A6/0412 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

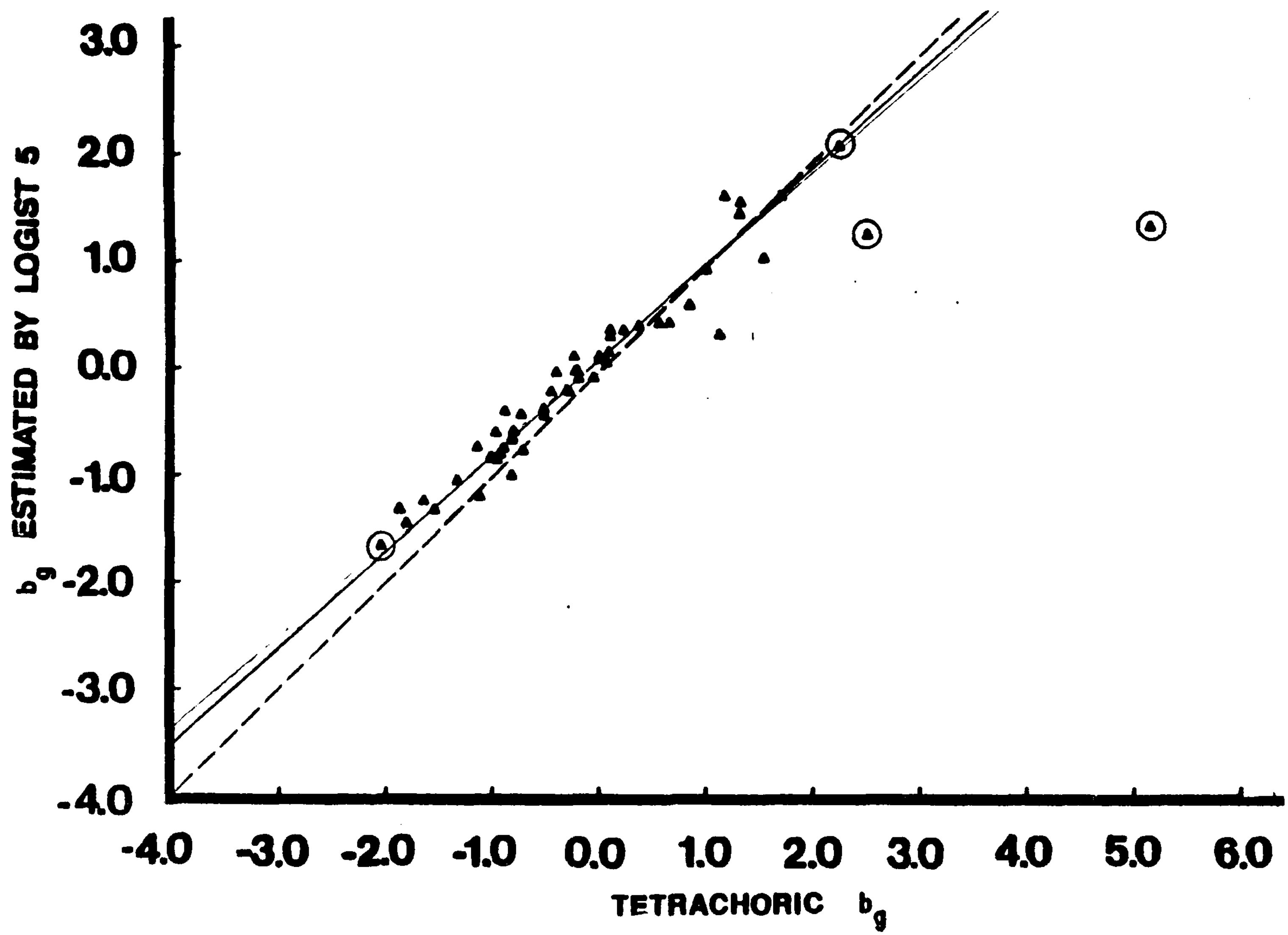


FIGURE 8-4 (Continued)

For the 55 Items of Test J1 Based upon the J1/0614 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

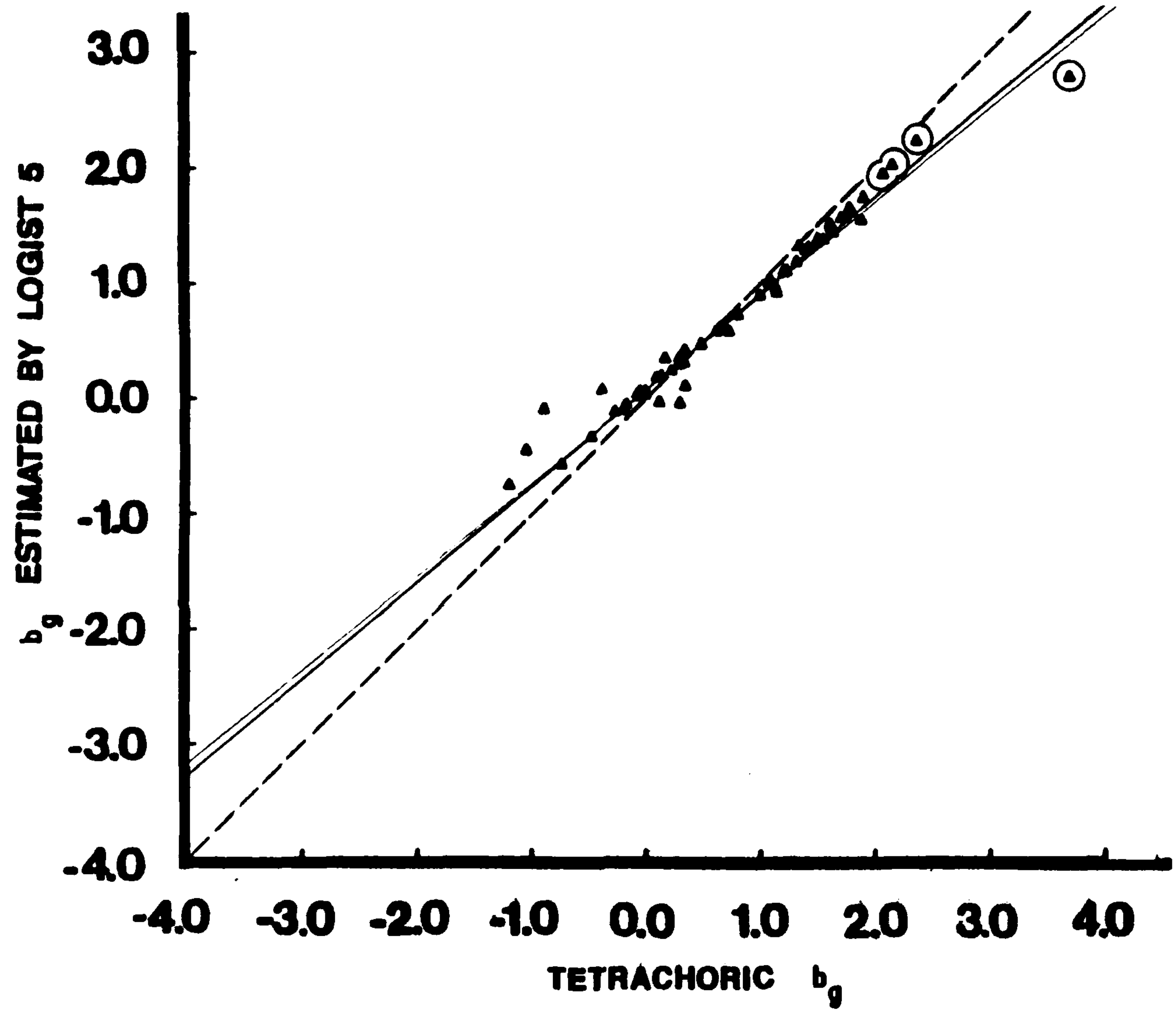


FIGURE 8-4 (Continued)

For the 59 Items of Test J2 Based upon the J2/0758 Case on the Abscissa And upon the Case A5-A6-J1-J2 on the Ordinate.

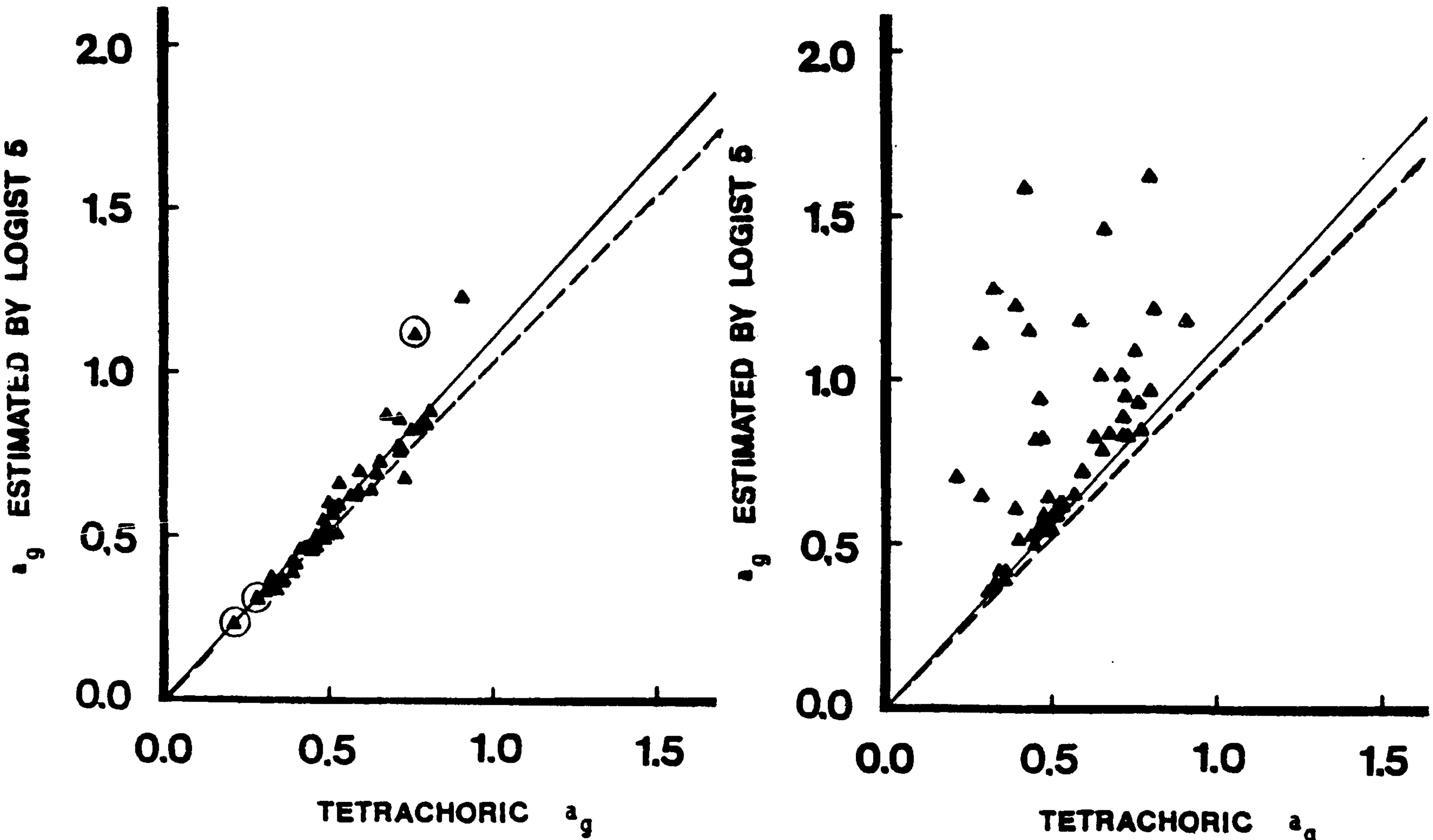


FIGURE 8-5

Estimated Item Discrimination Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment I. In Using Logist 5, Logistic Model Is Assumed in the Graph on the Left Hand Side And Three-Parameter Logistic Model Is Assumed in the Graph on the Right Hand Side. The Best Fitted Linear Relationship When the Logistic Model Is Asssumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. J1/1075 Case.

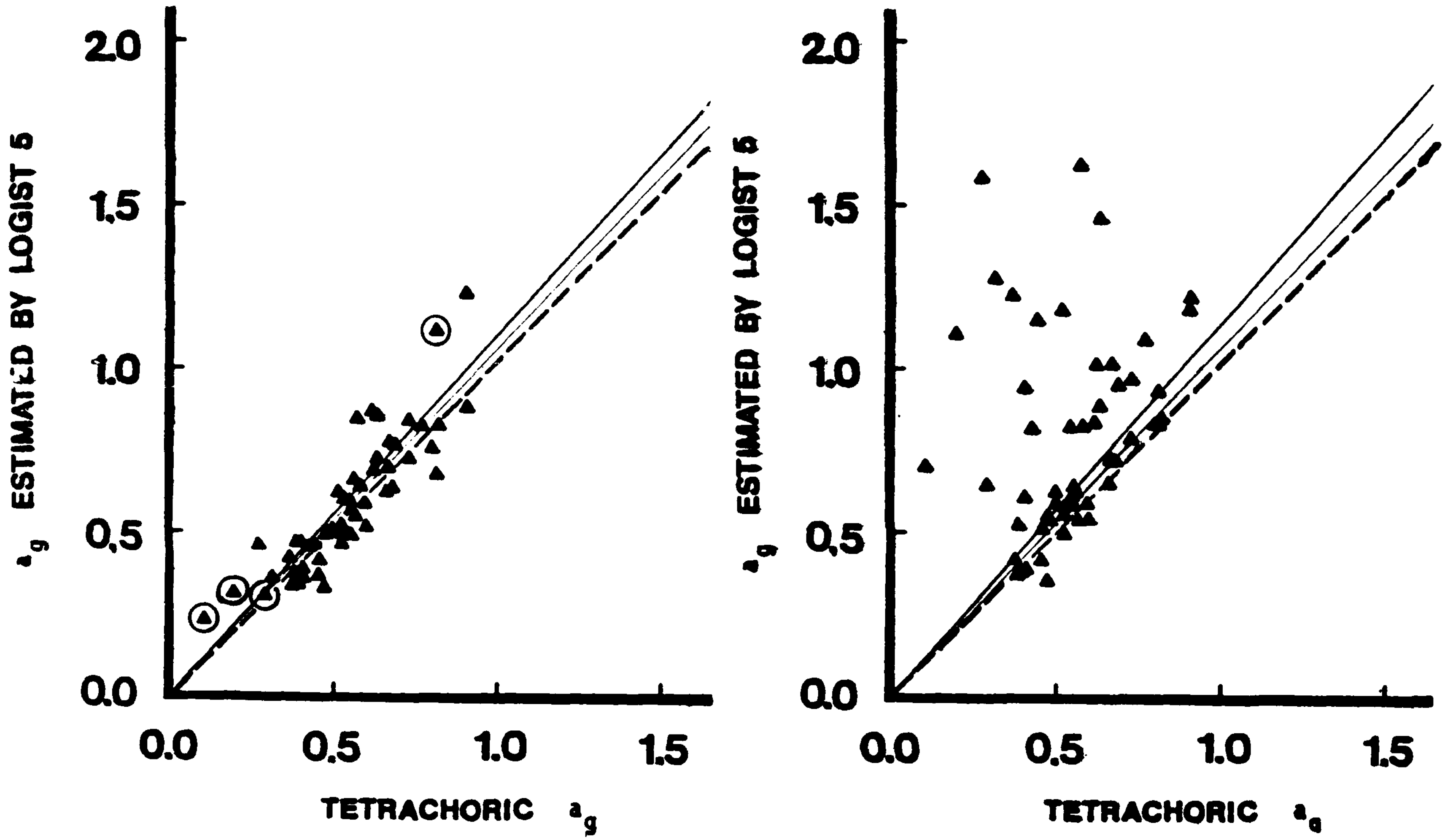


FIGURE 8-5 (Continued)

J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

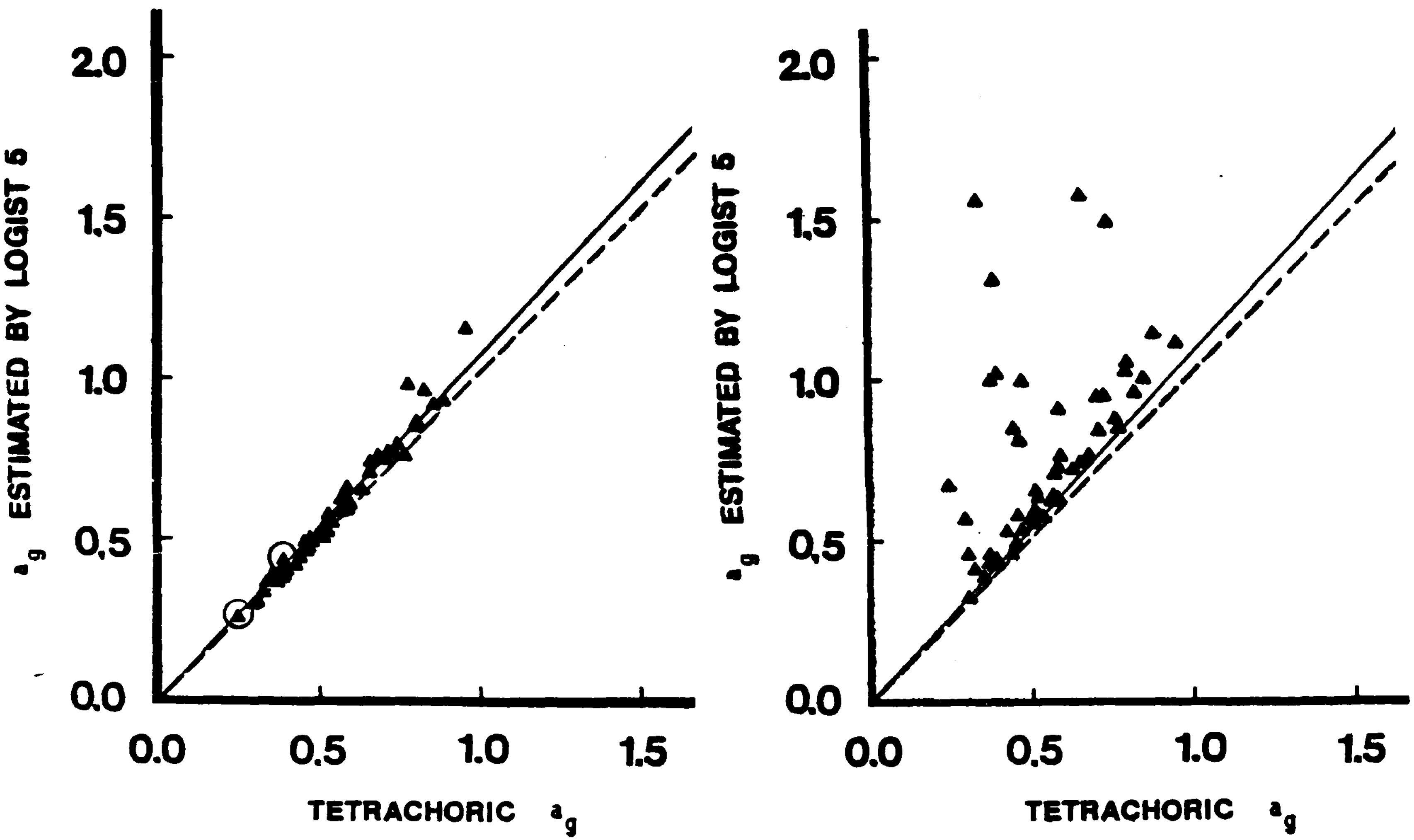


FIGURE 8-5 (Continued): J1/2259 Case.

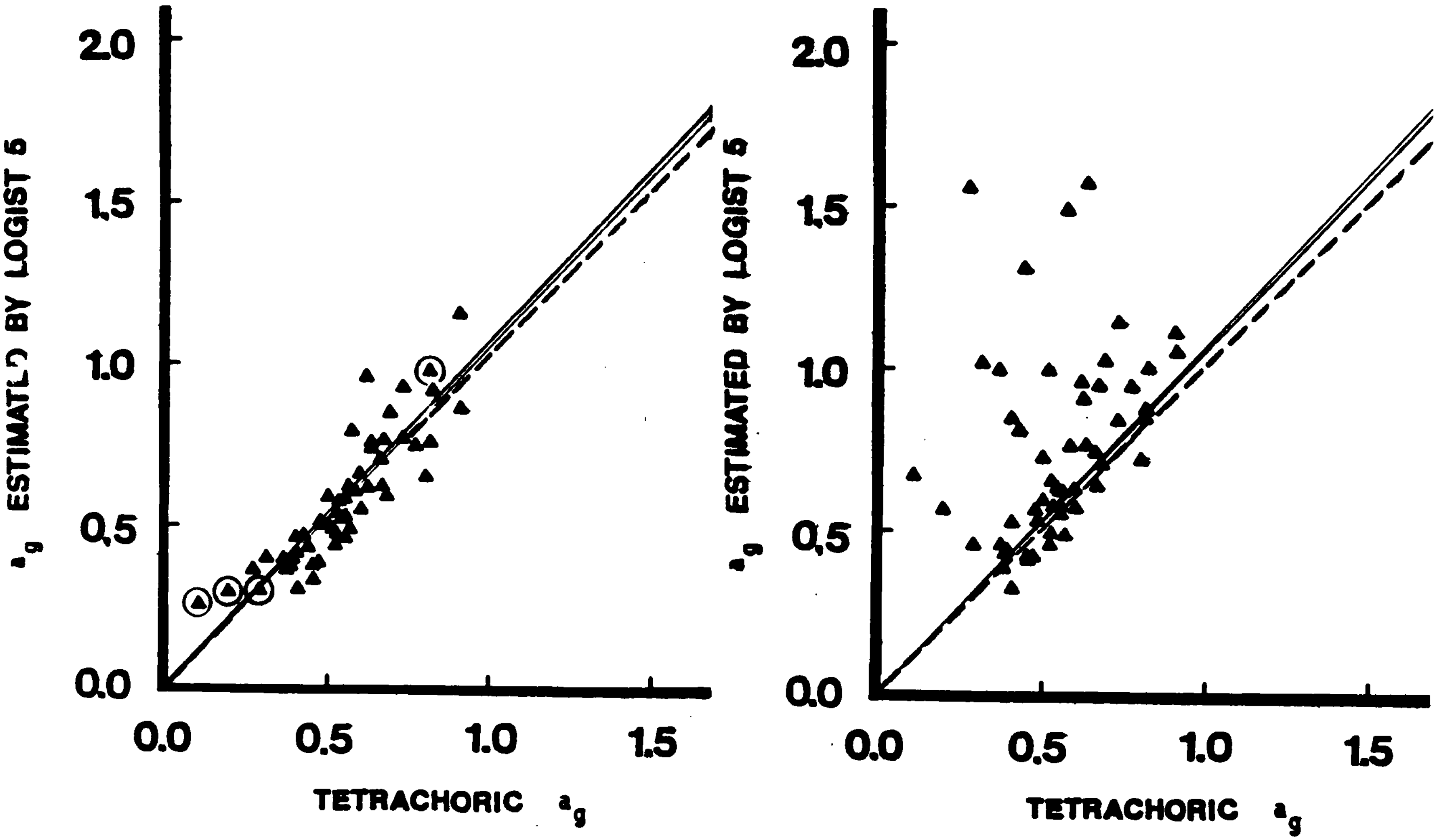


FIGURE 8-5 (Continued)

J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

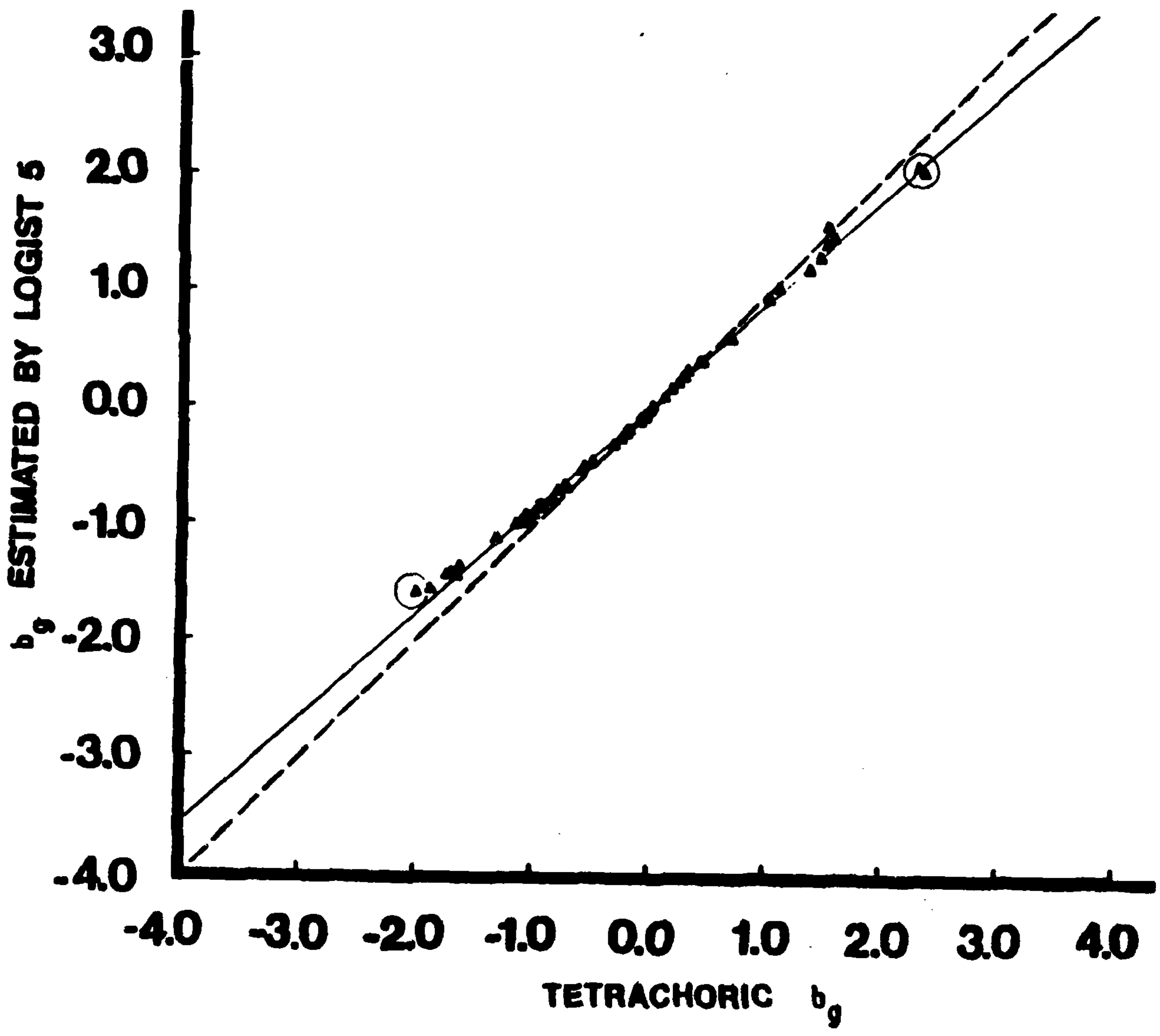


FIGURE 8-6

Estimated Item Difficulty Parameters of the 55 Items of Test J1 Obtained by Logist 5 Plotted against Those Obtained by the Tetrachoric Method, Which Are Adjusted to the Single Ability Scale by Scale Adjustment 1. The Best Fitted Linear Relationship When the Logistic Model Is Assumed Is Drawn by a Thin, Solid Line And the One Based upon Both Parameters Are Shown by a Thick, Solid Line. Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

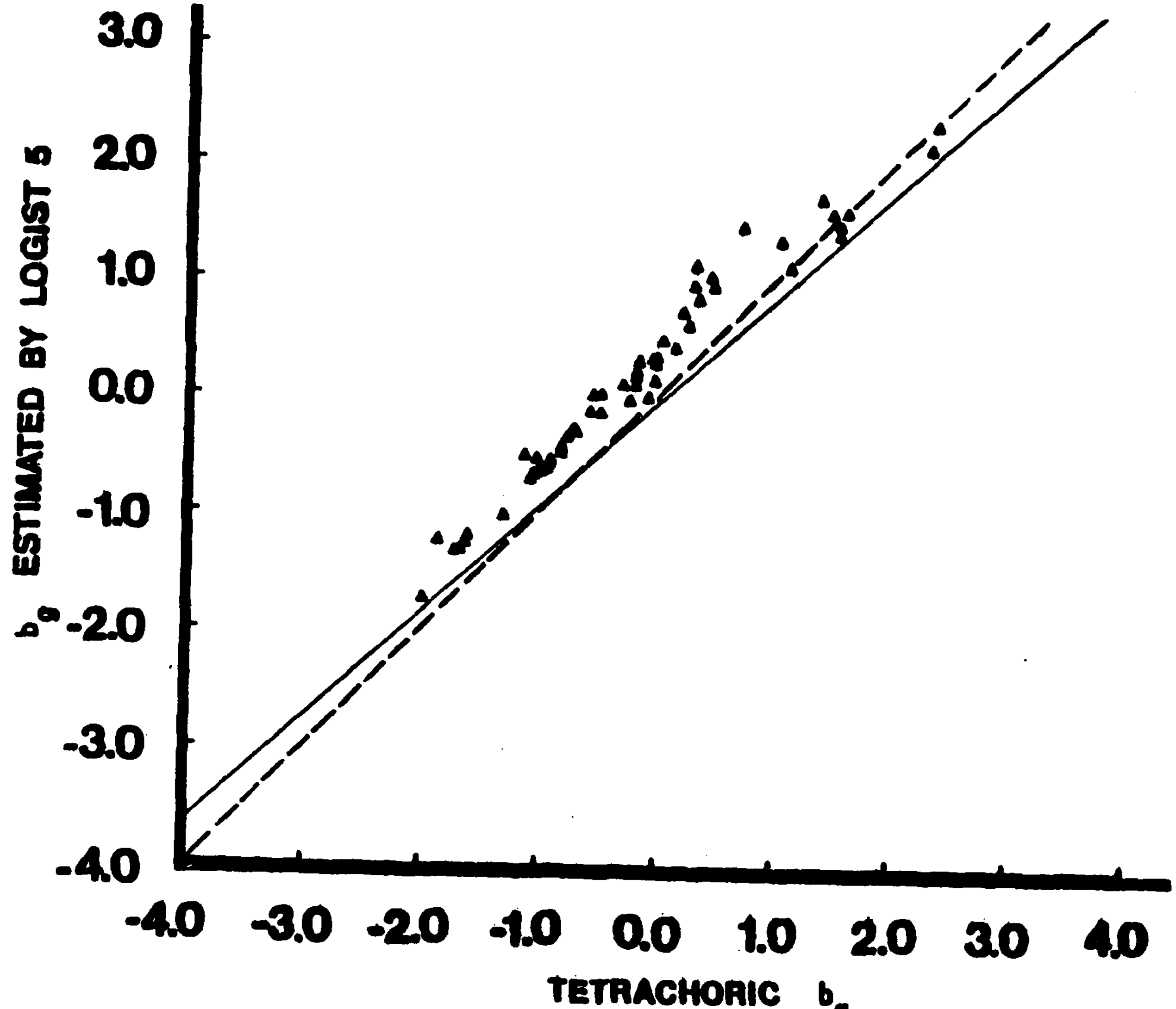


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/1075 Case.

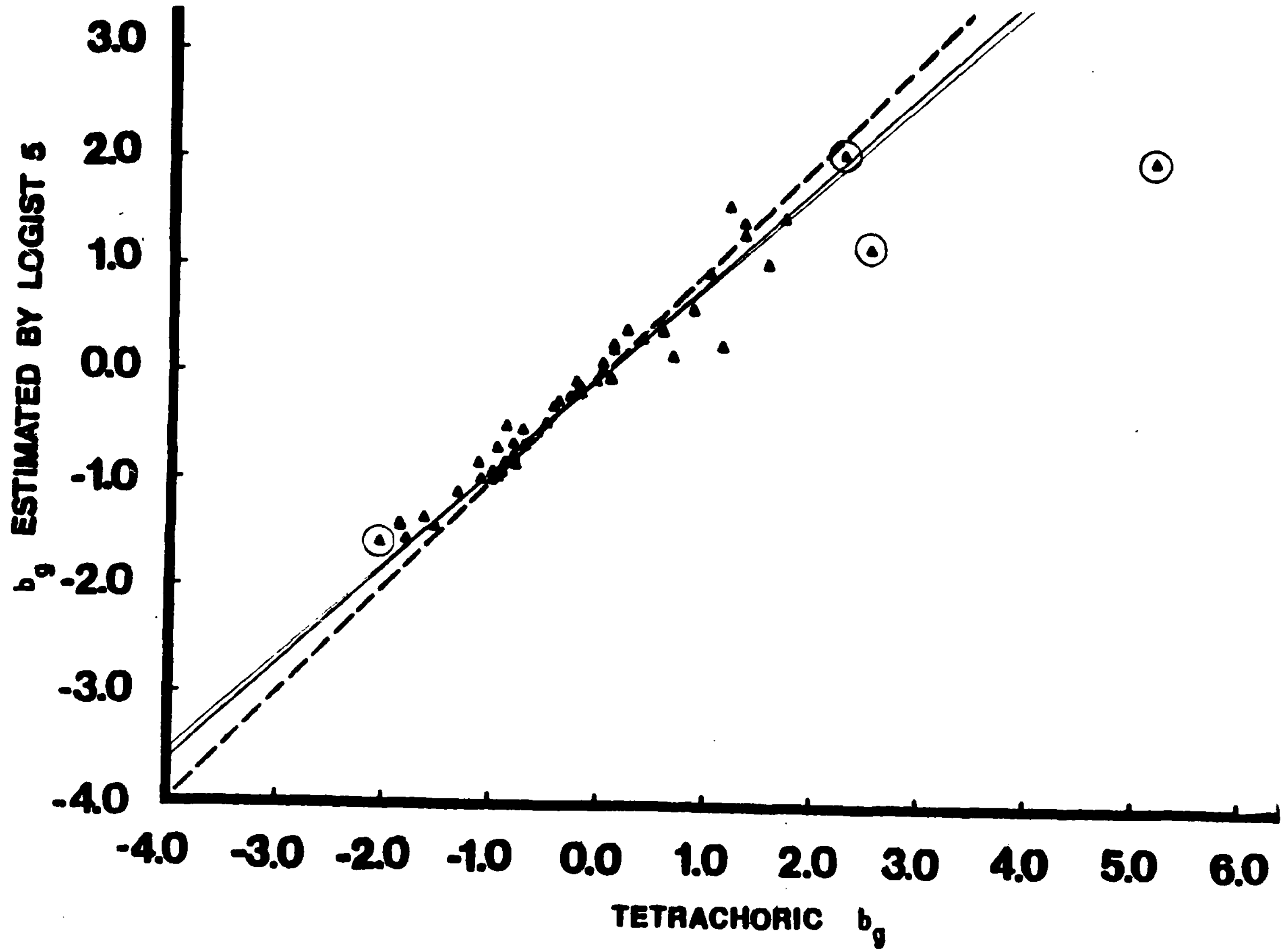


FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

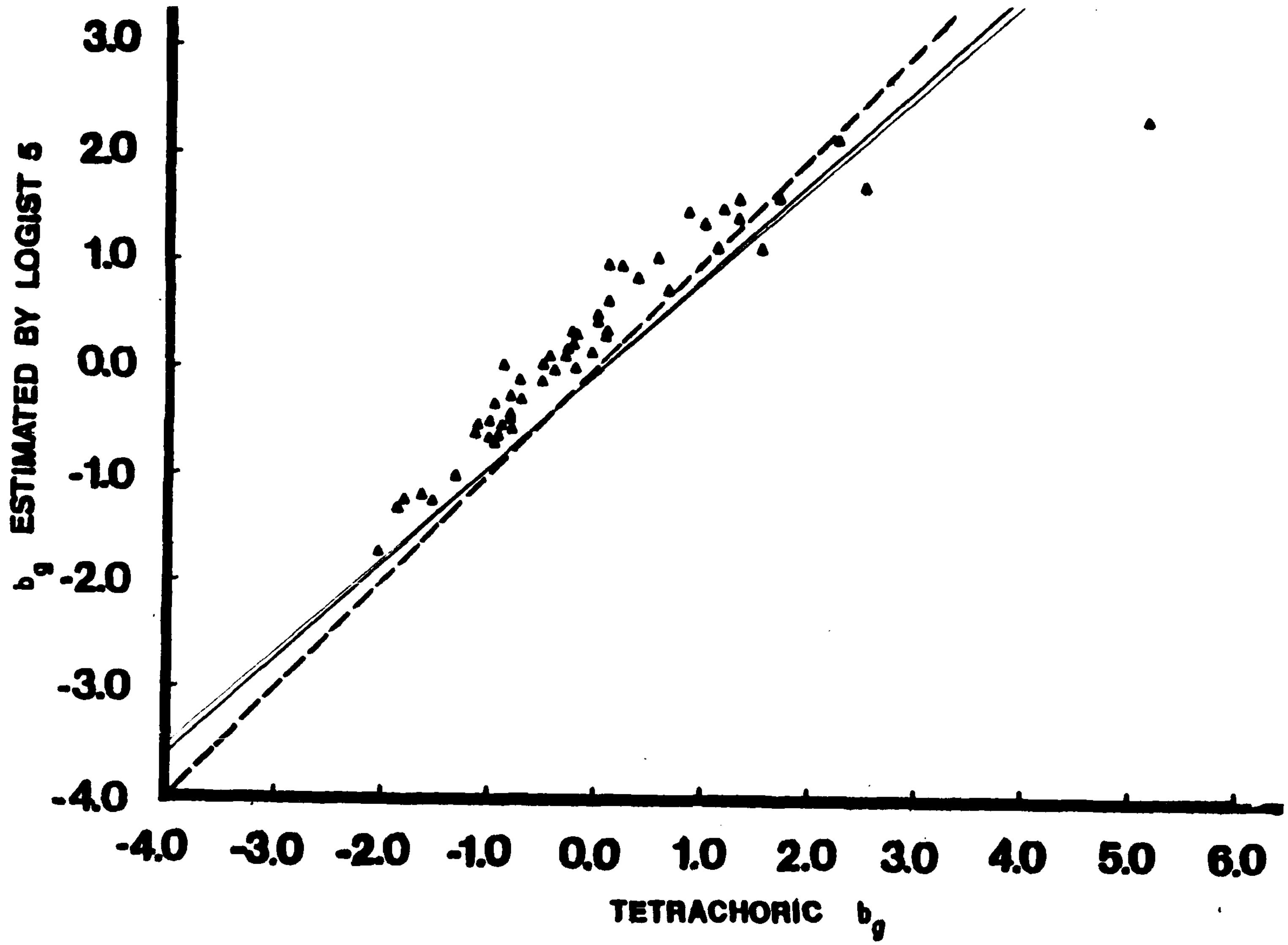


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/1075 Case on the Ordinate.

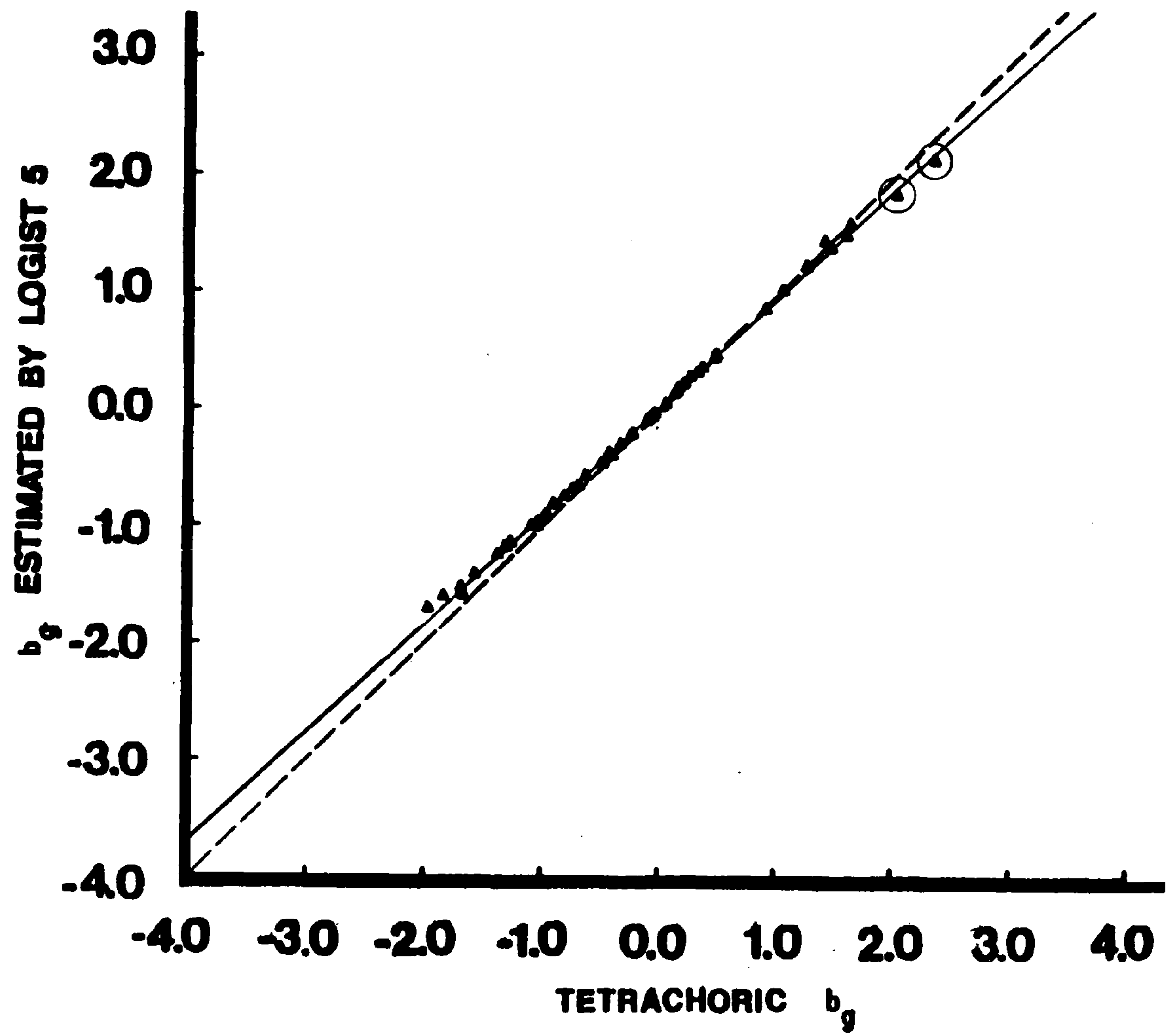


FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

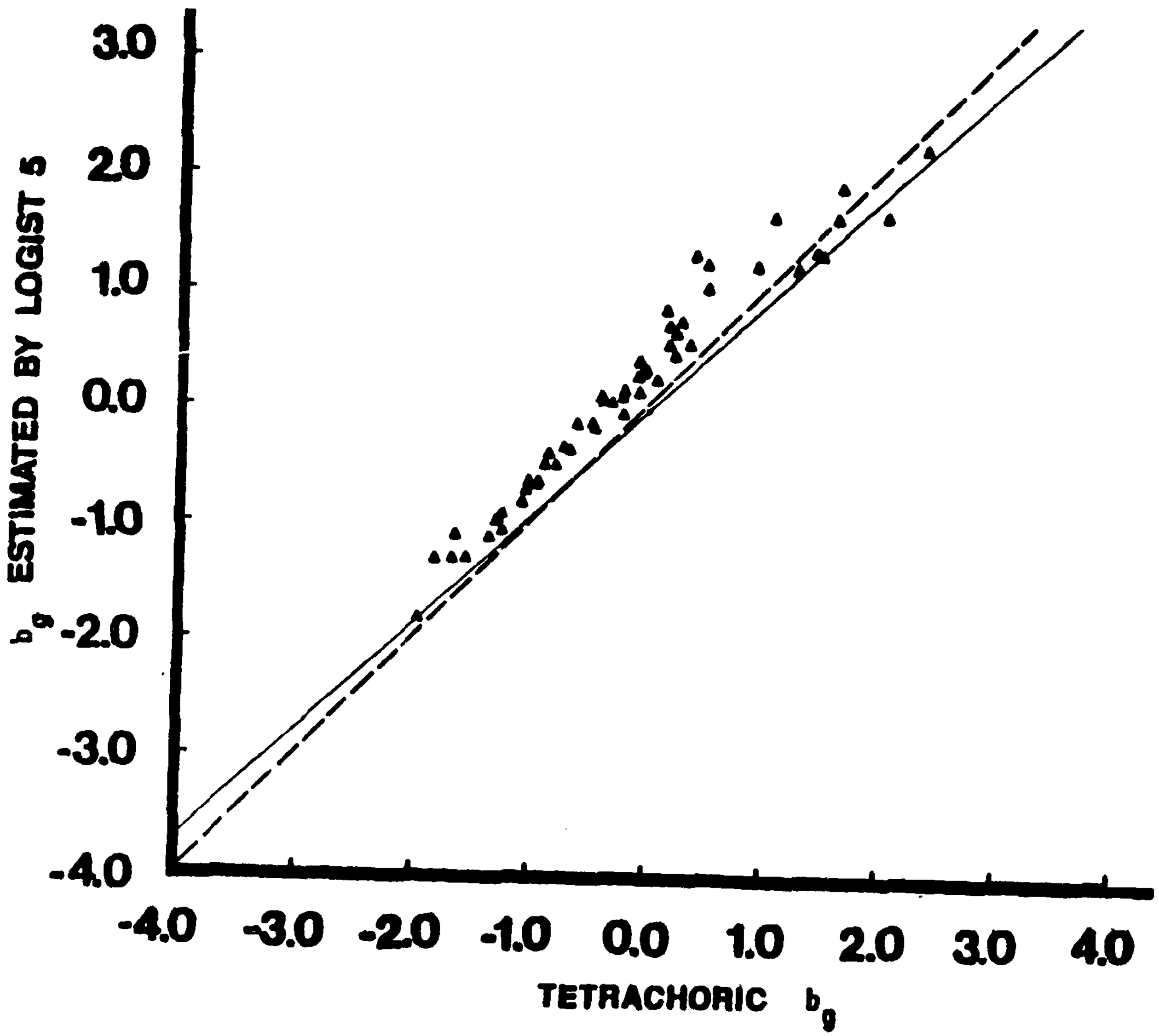


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/2259 Case.

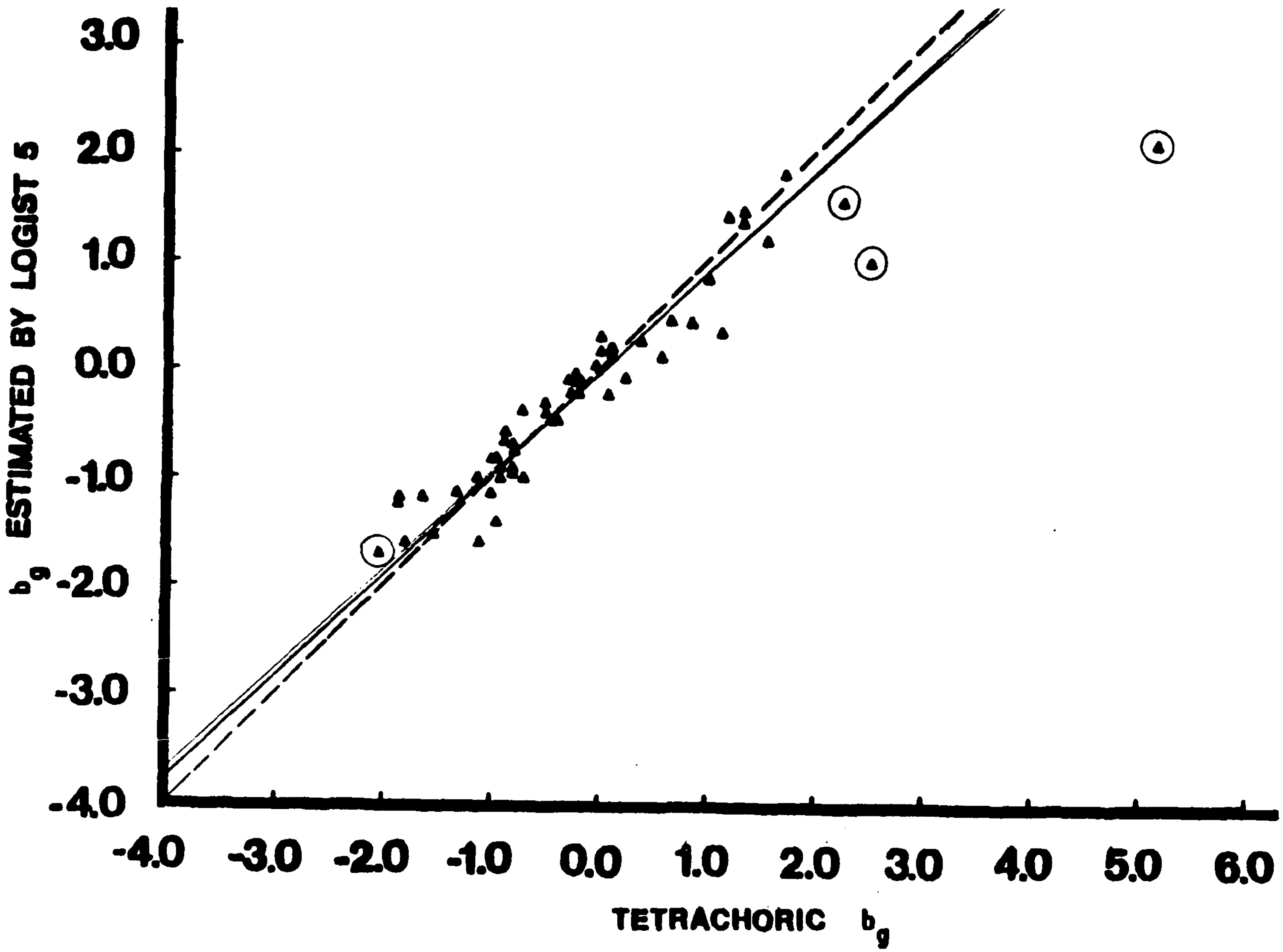


FIGURE 8-6 (Continued)

Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

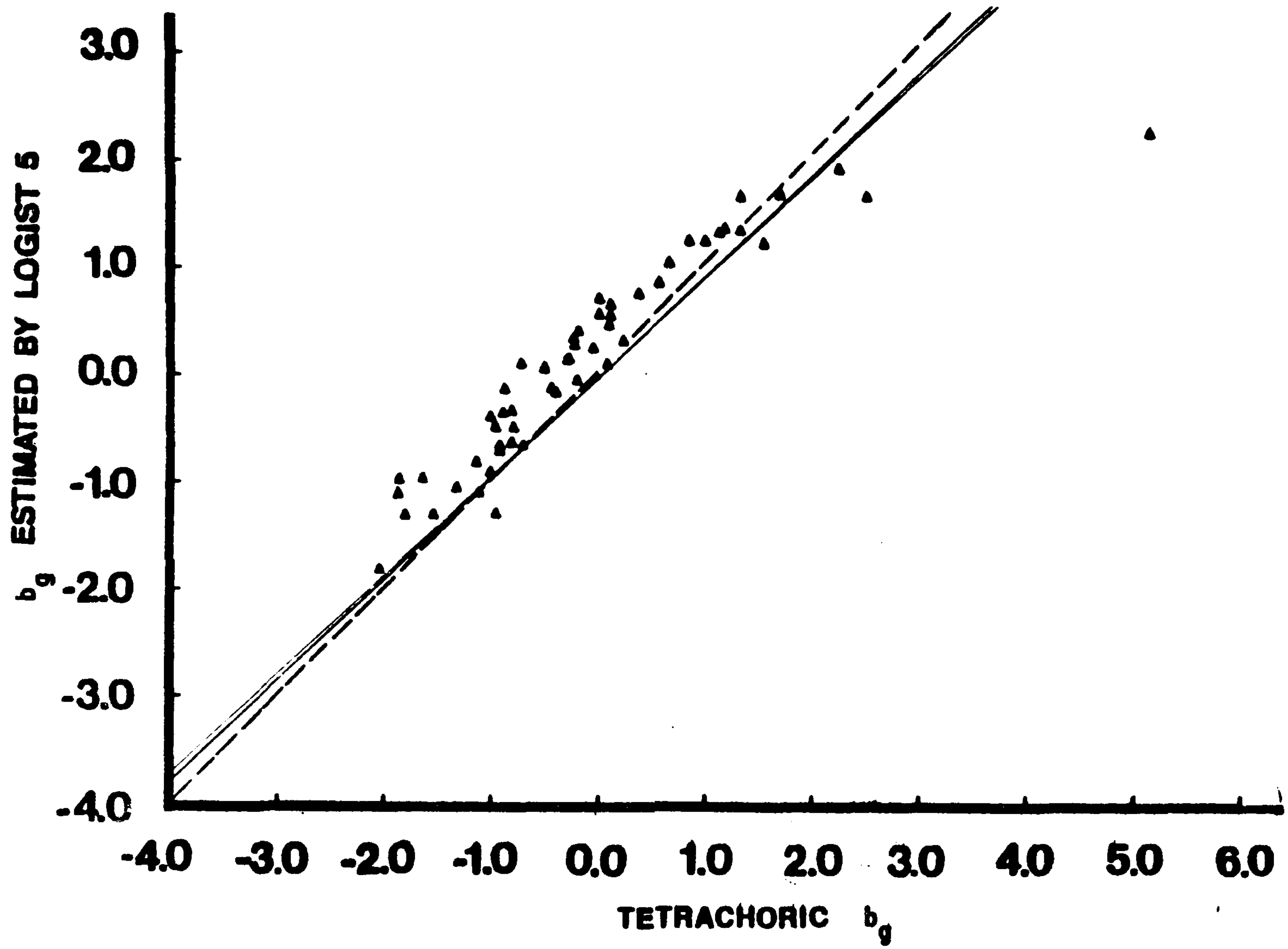


FIGURE 8-6 (Continued)

Three-Parameter Logistic Model Is Assumed in Using Logist 5. J1/0614 Case on the Abscissa And J1/2259 Case on the Ordinate.

This line is drawn by a long dashed line in each graph of Figures 8-1 through 8-6. We can see that most of these long dashed lines do not pass through the respective scatter diagrams as we expect best fitted linear relationships do.

For the sake of comparison, the best fitted linear iterative relationship for each scatter diagram of Figures 8-1 through 8-6 was obtained by the same iterative method that was described in Section 6, and also the results for $\hat{a}_g$ and for $\hat{b}_g$ were combined. In so doing, all the items whose rescaled estimated difficulty parameters exceed 2.0 were excluded. Table 8-1 presents the slopes and intercepts of the best fitted linear relationships thus obtained. The resulting linear relationships are shown in each graph of Figures 8-1 through 8-6 by thin and thick solid lines, the former of which indicates the direct result obtained for the specific parameter and the latter indicates the combined result. The circled plots in these figures indicate that these items were excluded in the process of using the iterative method for obtaining the respective best fitted linear relationships. As we can see in these graphs and Table 8-1, the best fitted linear relationship is substantially different from the corresponding long dashed line in most cases.

Thus we shall throw away the assumption that the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of θ, and go back to Table 7-25, which is presented at the end of the preceding section. Table 8-2 presents the direct estimates of the mean and the standard deviation of the distribution

TABLE 8-1

Slope And Intercept of Each of the Fitted Linear Relationship between the Two Sets of Estimated Discrimination Parameters, And Also Those of Estimated Difficulty Parameters, of the Common Test Items, Which Were Obtained by the Tetrachoric Method (Examinee Group 1) And by Logist 5 (Examinee Group 2), after Scale Adjustment I.

Examinee Group 1	Examinee Group 2	$\hat{a}_g$		Combined	$\hat{b}_g$		Combined	
		Slope	Intercept	Slope	Slope	Intercept	Slope	Intercept
A5/0599	A5-A6	1.106	-0.016	1.120	0.882	-0.149	0.893	-0.138
A6/0412	A5-A6	1.068	-0.009	1.078	0.919	-0.040	0.928	-0.032
J1/0614	A5-A6	1.146*	-0.028*	0.881*	1.476*	0.380*	1.135*	0.180*
J1/0614	J1-J2	1.032	-0.007	1.061	0.917	0.033	0.943	0.041
J2/0758	J1-J2	1.055	-0.009	1.097	0.876	0.062	0.912	0.039
A5/0599	A5-A6-J1-J2	0.878	-0.007	0.926	1.025	-0.044	1.080	-0.005
A6/0412	A5-A6-J1-J2	0.908	-0.007	0.933	1.044	0.055	1.072	0.081
J1/0614	A5-A6-J1-J2	1.080	-0.004	1.112	0.873	0.079	0.899	0.087
J2/0758	A5-A6-J1-J2	1.139	-0.010	1.185	0.811	0.113	0.844	0.093
J1/1075	J1/1075	1.102	-0.006	1.105	0.903	0.016	0.905	0.016
J1/0614	J1/1075	1.067	-0.008	1.104	0.876	0.008	0.906	0.017
J1/2259	J1/2259	1.075	-0.007	1.075	0.931	0.016	0.931	0.016
J1/0614	J1/2259	1.060	-0.009	1.072	0.923	0.008	0.933	0.012

* This is based on only 15 items while all the other results are based on at least 24 items.

AD-A164 186 COMPARISON OF THE ESTIMATED ITEM PARAMETERS OF SHIBA'S WORD/PHASE COMPREH (U) TENNESSEE UNIV KNOXVILLE F SAMEJIMA 13 DEC 85 RR-84-2 N00014-81-C-0569 3/4

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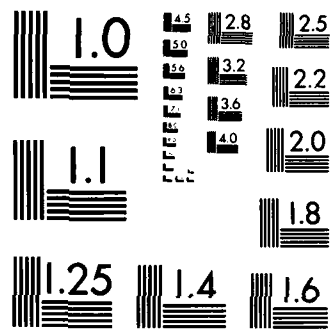

MICROCOPY RESOLUTION TEST CHART

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TABLE 8-2

Estimated Mean And Standard Deviation of the Distribution of $\hat{\theta}$ for Each Examinee Group Shown As Examinee Group 2, for Which Logist 5 Was Used. Examinee Group 1 Indicates the Group upon Which Tetrachoric Method Was Applied And Whose Result Was Paired with the Result of Examinee Group 2.

Examinee Group 1	Examinee Group 2	Mean	S.D.
A5/0599	A5-A6	-0.6769062928917D 00	0.9498435120987D 00
A6/0412	A5-A6	-0.7567180593797D 00	0.9441285727625D 00
J1/0614	A5-A6	-0.7540791085704D 00*	0.8971611496158D 00*
Weighted Average		-0.7094309692449D 00	0.9475145753959D 00
J1/0614	J1-J2	0.7790302264265D 00	0.1376714237914D 01
J2/0758	J1-J2	0.8197747749259D 00	0.1406229808384D 01
Weighted Average		0.8015406985566D 00	0.1393020945214D 01
A5/0599	A5-A6-J1-J2	0.1883270334869D 00	0.1216020629981D 01
A6/0412	A5-A6-J1-J2	0.1514122790061D 00	0.1285118299006D 01
J1/0614	A5-A6-J1-J2	0.1704262695468D 00	0.1522456056989D 01
J2/0758	A5-A6-J1-J2	0.1938391161783D 00	0.1601146033909D 01
Weighted Average		0.1790858294478D 00	0.1429425853648D 01
J1/1075	J1/1075	0.3017500674956D 00	0.1205953781811D 01
J1/0614	J1/1075	0.2970263355266D 00	0.1202006556190D 01
Weighted Average		0.3000328552819D 00	0.1204518851952D 01
J1/2259	J1/2259	0.3018676309476D 00	0.1077806694358D 01
J1/0614	J1/2259	0.3031684135164D 00	0.1080768213593D 01
Weighted Average		0.3021456262477D 00	0.1078439612148D 01

* This is based on only 14 items while all the other results are based on at least 36 items. This result was excluded from the computation of the weighted average.

of $\hat{\theta}$ for each of the three examinee groups, A5/0599, A6/0412 and J2/0758 Cases, and also of the two examinee groups, J1/1075 and J1/2259, which was obtained from the combined linear relationship in each case. Since there are more than one way of obtaining these two values in each case, all of these results are presented in Table 8-2. In this table, Examinee Group 1 indicates the group of examinees upon which the item parameters were estimated by Tetrachoric Method, and Examinee Group 2 means the group of individuals upon which they were estimated by Logist 5 . Thus the mean and the standard deviation of the distribution of $\hat{\theta}$ of Case J1-J2, for example, can be estimated in two ways, i.e., through the scatter diagrams of the estimated parameters of the items of Test J1, and through those of the items of Test J2. Since the mean and the standard deviation of the distribution of θ for each of J1/0614 Case and J2/0758 Case were already estimated and are shown in Table 6-3, from the slope and the intercept of the combined linear relationship shown in Table 7-25 and by using the method described in Section 6, we can obtain the estimates of the mean and the standard deviation of the distribution of $\hat{\theta}$ of Case J1-J2 in each case. In the same table, the weighted averages of the estimated mean and standard deviation of the distribution of $\hat{\theta}$ are also given for each examinee group. The weight adopted here is the number of the examinees in Examinee Group 1. We can see in these results that most estimates for the same group of examinees are close to each other. One exception is seen in Case A5-A6-J1-J2, however, for which the four estimates of the standard

deviation of the distribution of $\hat{\theta}$ are substantially different from one another.

The estimated item discrimination and difficulty parameters of each of the items of Tests A5, A6, J1 and J2, which are shown in Tables 7-1 through 7-12, were transformed through (6.1) and (6.18) by setting $\mu_1 = 0$ and $\sigma_1 = 1$ and by using the results shown in Table 8-2 as μ_2 and σ_2. In so doing, each separate set of the estimated mean and standard deviation were used, not their weighted averages. These results are shown in Tables 8-3 through 8-14. As was expected, the two sets of the parameter estimates of Test J1 obtained upon Case J1/1075: c_g-Zero and upon Case J1/2259: c_g-Zero, which are shown in Tables 8-11 and 8-13, respectively, are very close to each other. Note that they are also close to the corresponding two sets of results obtained by Tetrachoric Method, which are shown as Tables 6-8 and 6-9.

IX. Comparison of the Estimated Item Characteristic Functions Obtained As the Results of the Logist 5 and Those Obtained by the Tetrachoric Method

Figures 9-1 through 9-4 present five estimated item characteristic functions for each of the items of Tests A5, A6, J1 and J2. In each graph, the result based upon the estimated item parameters obtained by Tetrachoric Method, which are shown in Tables 6-4 through 6-7, is drawn by a solid line, and all the other four curves of different lengths of dashes concern with those based upon the estimated item parameters by Logist 5. Note that the first

TABLE 8-3

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A501	0.842	-2.308
A502	0.587	-3.269●
A503	0.669	-3.406●
A504	0.703	-2.065
A505	0.887	-2.395
A506	0.526	-2.049
A507	0.561	-0.968
A508	0.866	-1.852
A509	1.614	-1.961
A510	0.724	-0.955
A511	0.545	-2.172
A512	0.777	-1.931
A513	1.160	-2.763
A514	1.014	-1.881
A515	0.539	-2.291
A516	0.480	0.478
A517	1.997	-2.332
A518	0.422	-2.484
A519	0.793	-1.969
A520	0.412	-3.122●
A521	0.723	-1.941
A522	0.460	-0.658
A523	0.094●	4.638●
A524	0.494	-2.058
A525	1.132	-2.004
A526	0.994	-0.843
A527	0.099●	-0.402
A528	0.481	-0.100
A529	0.604	-0.574
A530	0.708	-1.754
A531	0.033●	38.517●
A532	0.577	0.032
A533	0.893	-1.824
A534	0.923	-2.166
A535	0.714	-1.336
A536	0.748	-1.136
A537	0.542	-1.364
A538	1.330	-0.974
A539	0.801	-1.029
A540	0.477	-0.692
A541	0.594	-0.902
A542	0.505	-1.465
A543	0.548	-1.130
A544	0.907	-0.491
A545	1.003	-0.661
A546	0.363	0.346
A547	0.324	-0.395
A548	0.533	-0.116

TABLE 8-4

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599 and A6/0412 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A601	0.899	-1.897
A602	0.929	-2.237
A603	0.718	-1.412
A604	0.753	-1.213
A605	0.546	-1.439
A606	1.338	-1.052
A607	0.806	-1.107
A608	0.480	-0.771
A609	0.597	-0.980
A610	0.508	-1.540
A611	0.551	-1.207
A612	0.912	-0.572
A613	1.009	-0.741
A614	0.365	0.260
A615	0.326	-0.476
A616	0.536	-0.199
A617	1.054	-1.628
A618	0.540	-1.259
A619	0.639	-1.244
A620	0.966	-0.646
A621	0.933	-1.006
A622	0.665	-1.718
A623	0.486	-1.529
A624	0.644	-2.211
A625	0.432	-1.881
A626	0.553	-1.075
A627	0.356	-0.496
A628	0.256	-2.790
A629	0.691	-0.673
A630	0.676	-1.068
A631	0.629	-0.889
A632	0.683	-1.492
A633	0.423	-1.220
A634	1.253	-1.697
A635	1.002	-2.208
A636	0.761	-1.676
A637	0.511	-1.165
A638	0.482	0.742
A639	0.059●	11.795●
A640	0.568	-0.190
A641	0.666	0.100
A642	0.697	-1.340
A643	0.774	-0.910
A644	1.215	-0.493
A645	0.515	-0.303
A646	0.526	-0.823
A647	0.568	0.362
A648	0.925	-1.784
A649	0.466	-0.823
A650	0.578	-0.389
A651	0.653	-1.005
A652	0.289	-1.116
A653	0.576	-0.797
A654	0.257	2.090
A655	0.907	-0.472
A656	0.529	-1.452

TABLE 8-5

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.704	-0.070
J102	0.466	-0.894
J103	0.630	-1.033
J104	0.656	-0.964
J105	0.691	-0.256
J106	0.444	-0.750
J107	0.458	-0.070
J108	1.003	-1.784
J109	0.295	-1.131
J110	0.569	-0.537
J111	1.109	-1.261
J112	0.419	-0.761
J113	0.514	-1.040
J114	0.562	0.171
J115	0.742	-0.250
J116	0.325	-1.109
J117	0.307	-0.569
J118	0.533	-1.085
J119	0.564	-1.026
J120	0.282	1.312
J121	0.450	-0.797
J122	0.471	-0.875
J123	0.442	0.230
J124	0.596	-1.614
J125	0.492	-1.621
J126	0.422	-0.603
J127	0.544	-1.525
J128	0.772	-0.950
J129	0.613	1.722
J130	0.336	-1.752
J131	0.795	-0.359
J132	0.376	0.017
J133	0.777	-1.595
J134	0.278	2.260
J135	0.745	-0.140
J136	0.302	0.343
J137	0.578	-0.018
J138	0.007	200.849
J139	0.360	1.665
J140	0.303	0.301
J141	0.499	-0.965
J142	0.440	0.377
J143	0.623	-0.224
J144	0.360	-0.620
J145	0.627	-0.155
J146	0.714	-0.213
J147	0.483	0.253
J148	0.514	0.295
J149	0.435	-0.147
J150	0.427	0.017
J151	0.522	0.945
J152	0.402	0.565
J153	0.389	1.738
J154	0.343	1.409
J155	0.801	1.066
J156	0.744	1.538

TABLE 8-6

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.566	0.005
J202	0.007●	205.179●
J203	0.352	1.724
J204	0.297	0.332
J205	0.488	-0.962
J206	0.431	0.409
J207	0.610	-0.205
J208	0.353	-0.609
J209	0.614	-0.134
J210	0.699	-0.193
J211	0.472	0.282
J212	0.503	0.325
J213	0.426	-0.126
J214	0.418	0.042
J215	0.511	0.989
J216	0.393	0.601
J217	0.381	1.799
J218	0.336	1.463
J219	0.784	1.113
J220	0.729	1.595
J221	0.331	1.952
J222	0.543	0.619
J223	0.360	-0.477
J224	0.531	0.604
J225	0.576	-0.047
J226	0.517	0.636
J227	0.520	0.199
J228	0.562	-0.224
J229	0.538	0.126
J230	0.473	0.145
J231	1.209	-0.013
J232	0.774	-0.148
J233	0.236	2.283
J234	0.274	1.531
J235	0.790	0.641
J236	0.720	0.771
J237	0.209	-0.072
J238	0.610	2.529
J239	0.391	1.211
J240	0.479	1.849
J241	0.924	-0.013
J242	0.624	0.272
J243	0.305	0.469
J244	0.224	1.025
J245	0.634	1.300
J246	0.203	1.680
J247	0.388	1.201
J248	0.309	-0.756
J249	0.531	1.076
J250	0.544	0.963
J251	0.744	0.259
J252	0.399	1.424
J253	0.439	1.498
J254	0.438	1.446
J255	0.838	1.530
J256	0.389	2.191
J257	0.407	1.087
J258	0.314	1.643
J259	0.599	1.747
J260	0.089●	3.160●

TABLE 8-7

Readjusted Estimated Item Discrimination Parameter a_g and Item Difficulty Parameter $\hat{b}_g$ of Each of the 48 Items of Test A5, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
A501	0.837	-2.316
A502	0.582	-3.287●
A503	0.664	-3.422●
A504	0.700	-2.070
A505	0.886	-2.399
A506	0.523	-2.055
A507	0.558	-0.967
A508	0.863	-1.856
A509	1.604	-1.967
A510	0.721	-0.955
A511	0.542	-2.180
A512	0.772	-1.937
A513	1.154	-2.772
A514	1.008	-1.886
A515	0.535	-2.300
A516	0.477	0.488
A517	1.978	-2.340
A518	0.419	-2.492
A519	0.790	-1.973
A520	0.409	-3.135●
A521	0.719	-1.946
A522	0.457	-0.656
A523	0.092●	4.754●
A524	0.490	-2.065
A525	1.127	-2.008
A526	0.987	-0.842
A527	0.100	-0.405
A528	0.477	-0.094
A529	0.601	-0.572
A530	0.701	-1.761
A531	0.030●	42.338●
A532	0.574	0.038
A533	0.900	-1.817
A534	0.932	-2.155
A535	0.721	-1.332
A536	0.762	-1.133
A537	0.549	-1.360
A538	1.341	-0.972
A539	0.810	-1.029
A540	0.485	-0.697
A541	0.606	-0.902
A542	0.513	-1.457
A543	0.558	-1.127
A544	0.919	-0.497
A545	1.016	-0.664
A546	0.367	0.327
A547	0.329	-0.406
A548	0.543	-0.132

TABLE 8-8

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test A6, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	Item	$\hat{a}_g$	$\hat{b}_g$
A601	0.852	-1.968	A641	0.803	-0.028
A602	0.882	-2.325	A642	0.513	-1.019
A603	0.682	-1.456	A643	0.753	-0.872
A604	0.721	-1.245	A644	0.933	-0.633
A605	0.520	-1.485	A645	0.708	-0.267
A606	1.269	-1.075	A646	0.513	-0.694
A607	0.766	-1.135	A647	0.587	0.066
A608	0.459	-0.784	A648	1.048	-1.636
A609	0.574	-1.001	A649	0.385	-0.861
A610	0.485	-1.588	A650	0.655	-0.436
A611	0.528	-1.239	A651	1.045	-1.066
A612	0.869	-0.573	A652	0.421	-0.801
A613	0.961	-0.749	A653	0.615	-0.834
A614	0.347	0.298	A654	0.586	0.321
A615	0.312	-0.477	A655	0.851	-0.281
A616	0.514	-0.187	A656	0.369	-1.205
A617	1.035	-1.654			
A618	0.523	-1.288			
A619	0.629	-1.262			
A620	0.962	-0.651			
A621	0.904	-1.023			
A622	0.648	-1.751			
A623	0.475	-1.558			
A624	0.631	-2.251			
A625	0.423	-1.914			
A626	0.542	-1.091			
A627	0.352	-0.502			
A628	0.252	-2.839			
A629	0.670	-0.683			
A630	0.664	-1.083			
A631	0.617	-0.901			
A632	0.671	-1.515			
A633	0.415	-1.239			
A634	1.220	-1.728			
A635	0.983	-2.245			
A636	0.743	-1.706			
A637	0.501	-1.184			
A638	0.475	0.753			
A639	0.061●	11.324●			
A640	0.552	-0.188			

TABLE 8-9

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.678	-0.042
J102	0.433	-1.217
J103	0.636	-1.042
J104	0.787	-0.758
J105	0.598	-0.325
J106	0.433	-0.832
J107	0.495	0.069
J108	0.884	-1.947
J109	0.325	-1.029
J110	0.553	-0.525
J111	0.882	-1.272
J112	0.356	-0.958
J113	0.519	-0.997
J114	0.495	0.372
J115	0.718	-0.341
J116	0.312	-1.436
J117	0.314	-0.548
J118	0.545	-1.053
J119	0.578	-0.993
J120	0.287	1.294
J121	0.461	-0.771
J122	0.480	-0.850
J123	0.454	0.233
J124	0.609	-1.570
J125	0.504	-1.574
J126	0.431	-0.582
J127	0.557	-1.482
J128	0.789	-0.922
J129	0.628	1.691
J130	0.343	-1.710
J131	0.812	-0.343
J132	0.383	0.024
J133	0.791	-1.558
J134	0.285	2.216
J135	0.763	-0.128
J136	0.308	0.344
J137	0.593	-0.010
J138	0.007	222.009
J139	0.369	1.629
J140	0.310	0.300
J141	0.512	-0.934
J142	0.451	0.375
J143	0.639	-0.210
J144	0.370	-0.597
J145	0.643	-0.143
J146	0.735	-0.198
J147	0.494	0.253
J148	0.527	0.295
J149	0.448	-0.133
J150	0.438	0.024
J151	0.536	0.928
J152	0.413	0.558
J153	0.400	1.699
J154	0.352	1.380
J155	0.824	1.047
J156	0.767	1.505

TABLE 8-10

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 60 Items of Test J2, Which Were Obtained by Logist 5 Based upon the Examinee Group Combining A5/0599, A6/0412, J1/1075 and J2/0758 Cases, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J201	0.563	0.004
J202	0.006●	233.498●
J203	0.351	1.728
J204	0.295	0.330
J205	0.487	-0.967
J206	0.429	0.409
J207	0.608	-0.207
J208	0.352	-0.613
J209	0.612	-0.136
J210	0.698	-0.194
J211	0.470	0.281
J212	0.501	0.325
J213	0.426	-0.126
J214	0.417	0.040
J215	0.510	0.991
J216	0.392	0.601
J217	0.381	1.801
J218	0.335	1.466
J219	0.783	1.116
J220	0.729	1.598
J221	0.332	1.950
J222	0.543	0.617
J223	0.361	-0.475
J224	0.532	0.604
J225	0.578	-0.045
J226	0.519	0.636
J227	0.520	0.198
J228	0.563	-0.223
J229	0.539	0.127
J230	0.473	0.145
J231	1.210	-0.012
J232	0.776	-0.147
J233	0.237	2.280
J234	0.275	1.529
J235	0.792	0.641
J236	0.720	0.770
J237	0.210	-0.068
J238	0.610	2.526
J239	0.391	1.209
J240	0.479	1.847

Item	$\hat{a}_g$	$\hat{b}_g$
J241	0.929	-0.011
J242	0.625	0.272
J243	0.304	0.467
J244	0.224	1.023
J245	0.635	1.299
J246	0.202	1.679
J247	0.389	1.200
J248	0.310	-0.756
J249	0.530	1.075
J250	0.545	0.962
J251	0.746	0.259
J252	0.400	1.422
J253	0.439	1.497
J254	0.438	1.444
J255	0.838	1.529
J256	0.390	2.188
J257	0.408	1.086
J258	0.315	1.641
J259	0.600	1.746
J260	0.088●	3.176●

TABLE 8-11

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.698	-0.071
J102	0.464	-0.897
J103	0.628	-1.037
J104	0.653	-0.967
J105	0.690	-0.257
J106	0.443	-0.750
J107	0.456	-0.069
J108	1.006	-1.783
J109	0.295	-1.127
J110	0.573	-0.534
J111	1.109	-1.264
J112	0.416	-0.767
J113	0.510	-1.049
J114	0.559	0.172
J115	0.742	-0.251
J116	0.322	-1.119
J117	0.306	-0.570
J118	0.528	-1.094
J119	0.561	-1.031
J120	0.280	1.322
J121	0.450	-0.796
J122	0.469	-0.878
J123	0.440	0.232
J124	0.595	-1.617
J125	0.493	-1.619
J126	0.420	-0.604
J127	0.541	-1.532
J128	0.771	-0.953
J129	0.609	1.735
J130	0.337	-1.750
J131	0.794	-0.361
J132	0.372	0.017
J133	0.784	-1.588
J134	0.274	2.292
J135	0.744	-0.140
J136	0.300	0.347
J137	0.576	0.094
J138	---	---
J139	0.378	1.441
J140	0.348	0.287
J141	0.535	-0.934
J142	0.420	0.430
J143	0.621	-0.217
J144	0.329	-0.534
J145	0.681	-0.306
J146	0.758	-0.090
J147	0.413	0.286
J148	0.444	0.436
J149	0.446	-0.225
J150	0.441	-0.100
J151	0.409	1.039
J152	0.323	0.661
J153	0.417	1.619
J154	0.206	2.247
J155	0.763	1.139
J156	0.653	1.564

TABLE 8-12

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/1075 Case, Assuming the Three-Parameter Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$	Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J101	0.915	0.309	0.146	J141	0.553	-0.617	0.143
J102	0.488	-0.550	0.143	J142	0.849	1.130	0.245
J103	0.652	-0.750	0.143	J143	0.914	0.323	0.201
J104	0.708	-0.657	0.143	J144	0.374	0.015	0.143
J105	0.857	0.100	0.137	J145	0.749	-0.045	0.103
J106	0.497	-0.316	0.143	J146	0.873	0.145	0.087
J107	0.563	0.367	0.143	J147	1.432	1.241	0.338
J108	0.839	-1.935	0.143	J148	0.742	1.041	0.207
J109	0.317	-0.574	0.143	J149	0.530	0.226	0.143
J110	0.648	-0.159	0.143	J150	0.521	0.352	0.143
J111	1.066	-1.147	0.143	J151	0.737	1.483	0.181
J112	0.446	-0.350	0.143	J152	1.154	1.612	0.331
J113	0.525	-0.731	0.143	J153	1.037	1.764	0.167
J114	1.066	0.797	0.234	J154	0.634	2.587	0.249
J115	0.982	0.182	0.173	J155	1.466	1.232	0.089
J116	0.349	-0.606	0.143	J156	1.320	1.544	0.086
J117	0.341	0.006	0.143				
J118	0.531	-0.803	0.143				
J119	0.586	-0.724	0.143				
J120	1.000	1.882	0.278				
J121	0.484	-0.398	0.143				
J122	0.499	-0.500	0.143				
J123	0.578	0.676	0.143				
J124	0.563	-1.482	0.143				
J125	0.485	-1.405	0.143				
J126	0.471	-0.151	0.143				
J127	0.527	-1.343	0.143				
J128	0.800	-0.700	0.143				
J129	0.747	1.641	0.018				
J130	0.334	-1.388	0.143				
J131	1.100	0.101	0.191				
J132	0.460	0.535	0.143				
J133	0.754	-1.472	0.143				
J134	0.582	2.370	0.162				
J135	0.765	-0.019	0.041				
J136	0.375	0.923	0.143				
J137	0.744	0.459	0.131				
J138	---	---	---				
J139	1.107	1.745	0.213				
J140	0.547	1.053	0.218				

TABLE 8-13

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$
J101	0.715	-0.247
J102	0.514	-0.983
J103	0.582	-1.238
J104	0.719	-0.812
J105	0.793	-0.104
J106	0.480	-0.746
J107	0.551	0.212
J108	0.915	-1.839
J109	0.361	-0.893
J110	0.553	-0.336
J111	1.080	-1.231
J112	0.410	-1.081
J113	0.494	-1.085
J114	0.456	0.490
J115	0.698	-0.240
J116	0.283	-1.721
J117	0.372	-0.626
J118	0.617	-1.523
J119	0.659	-0.979
J120	0.274	1.072
J121	0.469	-0.879
J122	0.442	-1.040
J123	0.431	0.147
J124	0.581	-1.278
J125	0.457	-1.645
J126	0.350	-0.414
J127	0.537	-1.274
J128	0.708	-1.083
J129	0.708	1.519
J130	0.364	-1.728
J131	0.806	-0.509
J132	0.310	0.186
J133	0.898	-1.343
J134	0.279	1.676
J135	0.858	-0.240
J136	0.339	0.286
J137	0.567	0.329
J138	---	---
J139	0.372	1.573
J140	0.389	0.221

Item	$\hat{a}_g$	$\hat{b}_g$
J141	0.545	-0.716
J142	0.433	0.132
J143	0.577	-0.106
J144	0.352	-0.437
J145	0.609	-0.508
J146	0.868	0.039
J147	0.339	0.375
J148	0.487	-0.080
J149	0.468	-0.122
J150	0.503	-0.047
J151	0.440	0.903
J152	0.374	0.465
J153	0.404	1.946
J154	0.238	2.266
J155	0.741	1.289
J156	0.690	1.463

TABLE 8-14

Readjusted Estimated Item Discrimination Parameter $\hat{a}_g$ and Item Difficulty Parameter $\hat{b}_g$ of Each of the 56 Items of Test J1, Which Were Obtained by Logist 5 Based upon the J1/2259 Case, Assuming the Three-Parameter Logistic Model.

Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$	Item	$\hat{a}_g$	$\hat{b}_g$	$\hat{c}_g$
J101	0.888	0.092	0.151	J141	0.583	-0.395	0.146
J102	0.534	-0.694	0.146	J142	0.793	0.903	0.267
J103	0.598	-0.989	0.146	J143	0.849	0.425	0.209
J104	0.788	-0.540	0.146	J144	0.395	0.059	0.146
J105	0.960	0.136	0.109	J145	0.674	-0.189	0.146
J106	0.529	-0.374	0.146	J146	1.070	0.258	0.101
J107	0.680	0.485	0.109	J147	1.458	1.407	0.373
J108	0.795	-1.959	0.146	J148	0.592	0.325	0.146
J109	0.394	-0.433	0.146	J149	0.556	0.286	0.146
J110	0.661	0.044	0.146	J150	0.612	0.348	0.146
J111	1.042	-1.144	0.146	J151	0.758	1.320	0.182
J112	0.427	-0.718	0.146	J152	0.952	1.325	0.308
J113	0.516	-0.774	0.146	J153	1.227	1.784	0.156
J114	0.932	1.103	0.245	J154	0.628	2.398	0.212
J115	0.886	0.151	0.172	J155	1.396	1.294	0.085
J116	0.301	-1.191	0.146	J156	1.474	1.426	0.095
J117	0.412	-0.157	0.146				
J118	0.589	-1.402	0.146				
J119	0.695	-0.720	0.146				
J120	0.530	1.769	0.229				
J121	0.497	-0.536	0.146				
J122	0.461	-0.692	0.146				
J123	0.540	0.579	0.146				
J124	0.580	-1.057	0.146				
J125	0.456	-1.409	0.146				
J126	0.402	0.097	0.146				
J127	0.538	-1.047	0.146				
J128	0.716	-0.887	0.146				
J129	0.821	1.448	0.013				
J130	0.360	-1.419	0.146				
J131	0.987	-0.149	0.178				
J132	0.383	0.749	0.146				
J133	0.898	-1.208	0.146				
J134	0.427	2.048	0.146				
J135	0.938	-0.067	0.085				
J136	0.426	0.797	0.146				
J137	0.713	0.592	0.108				
J138	---	---	---				
J139	0.933	1.762	0.193				
J140	0.493	0.688	0.146				

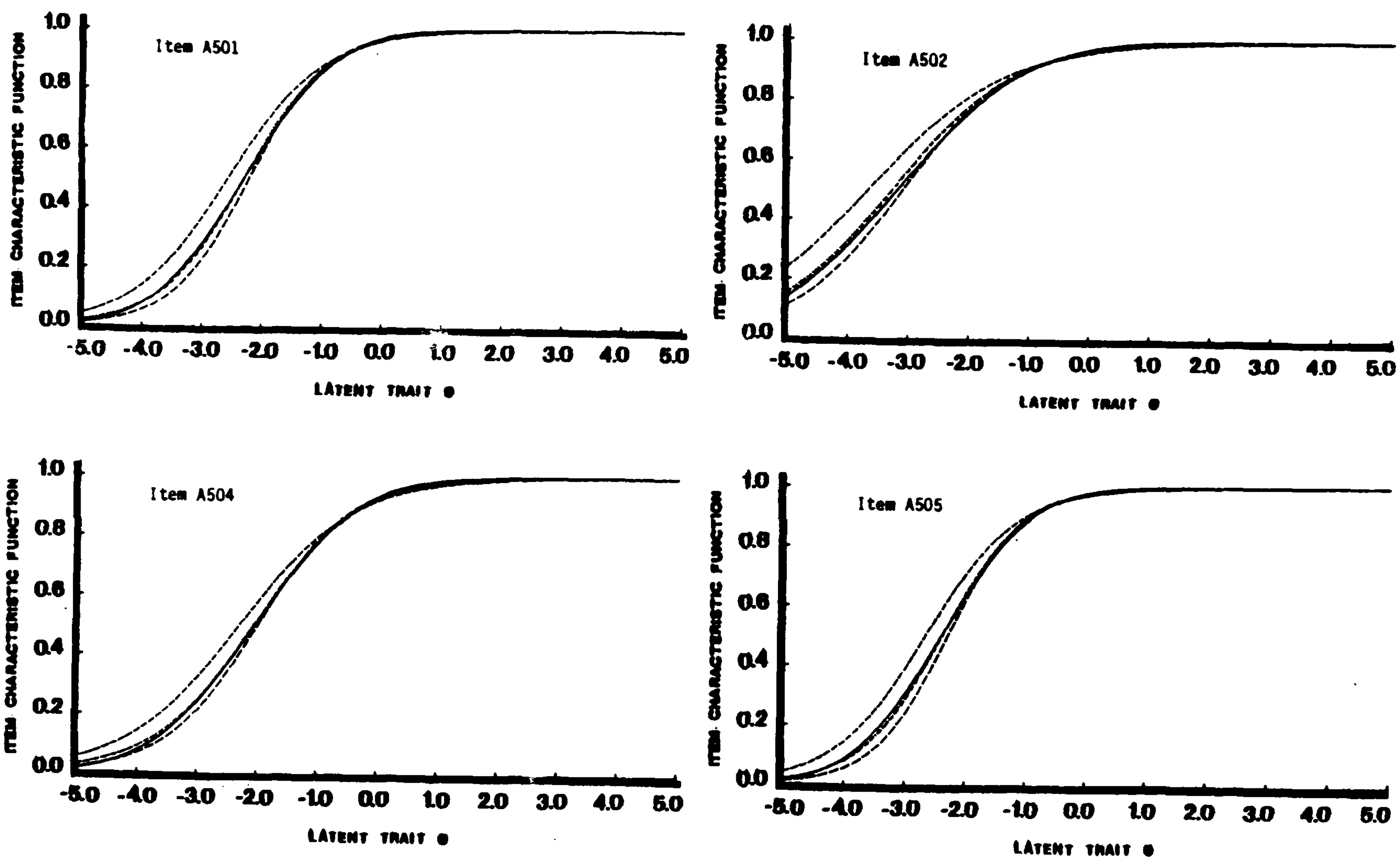


FIGURE 9-1

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the A5-A6 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test A5.

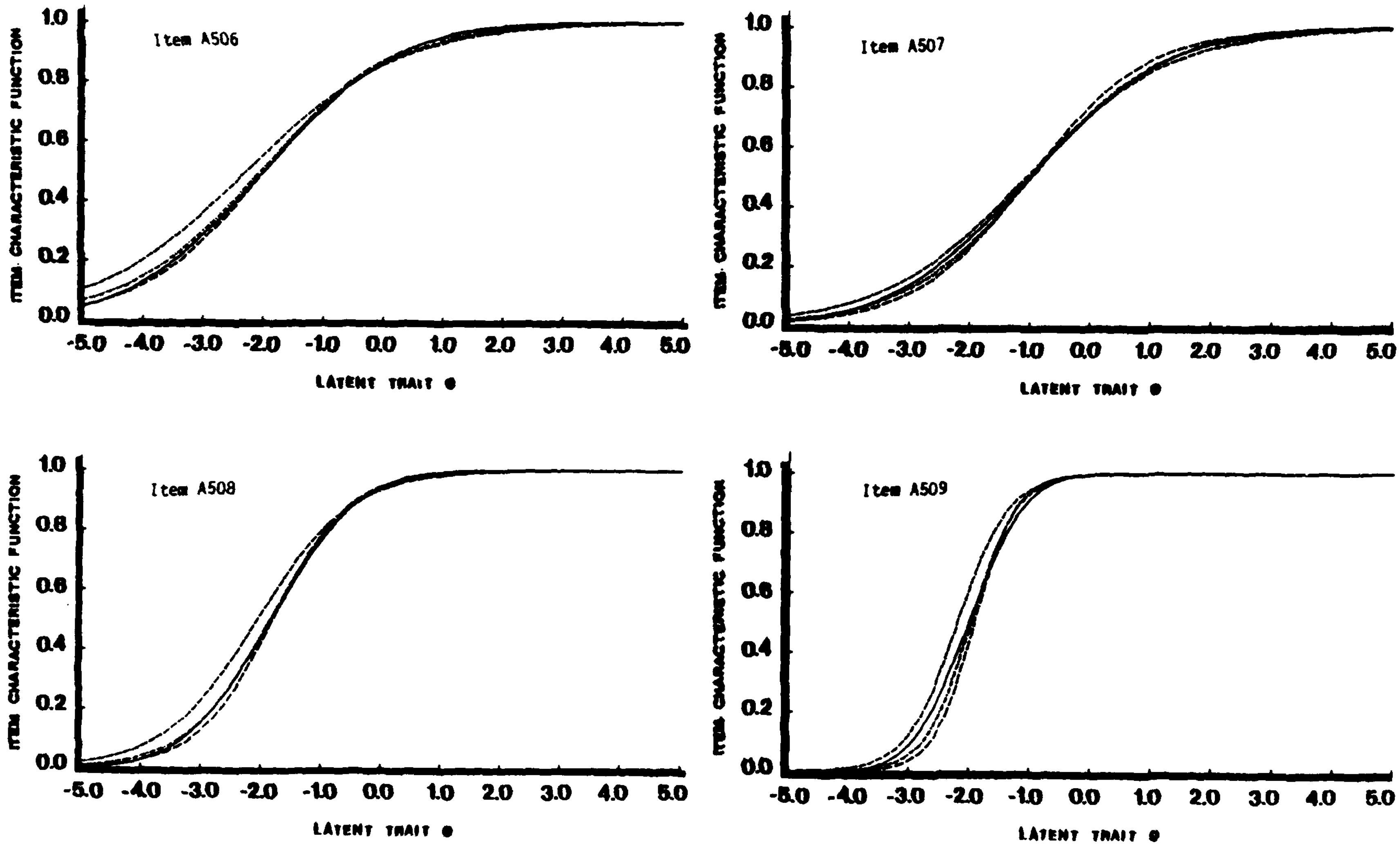


FIGURE 9-1 (Continued)

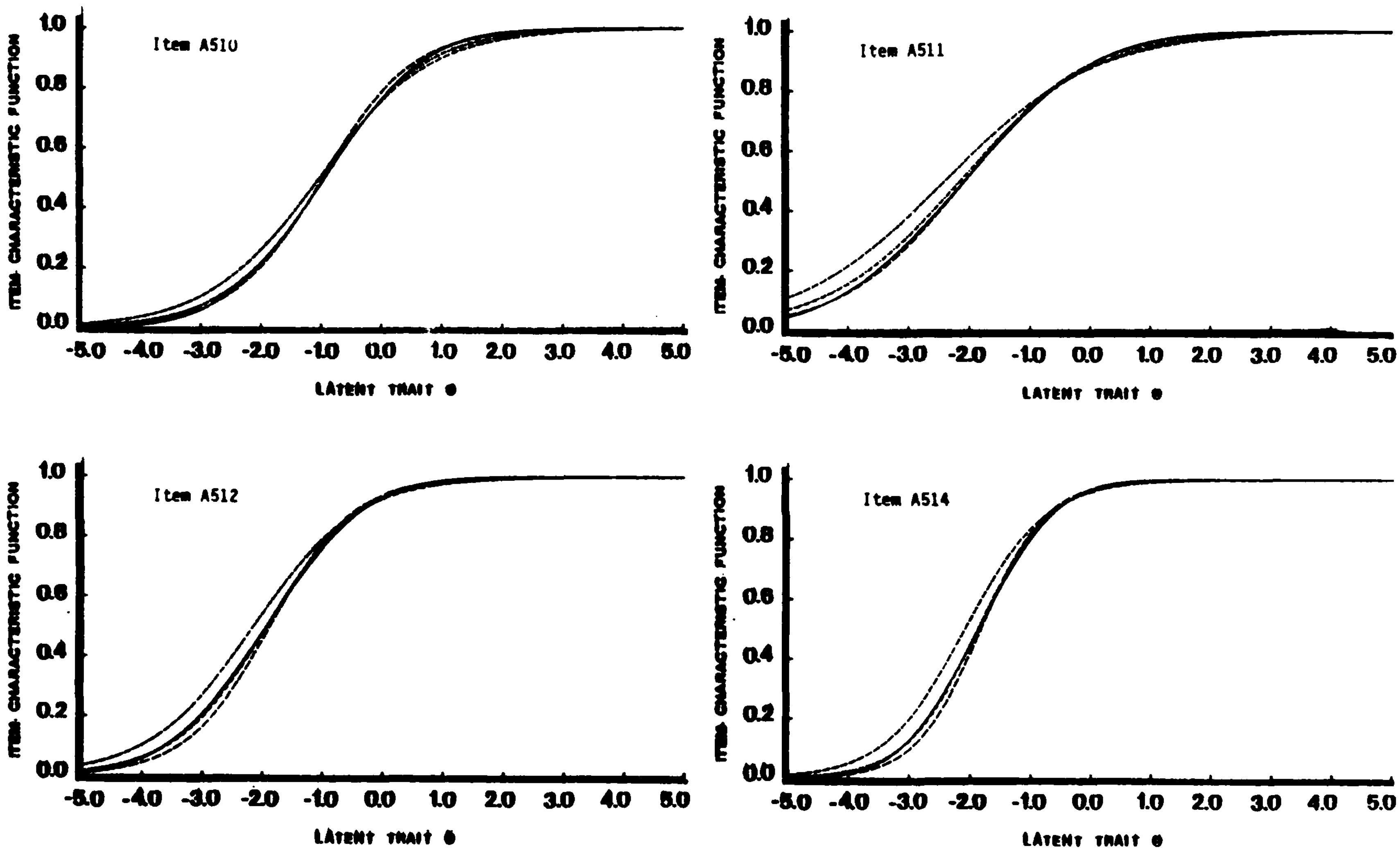


FIGURE 9-1 (Continued)

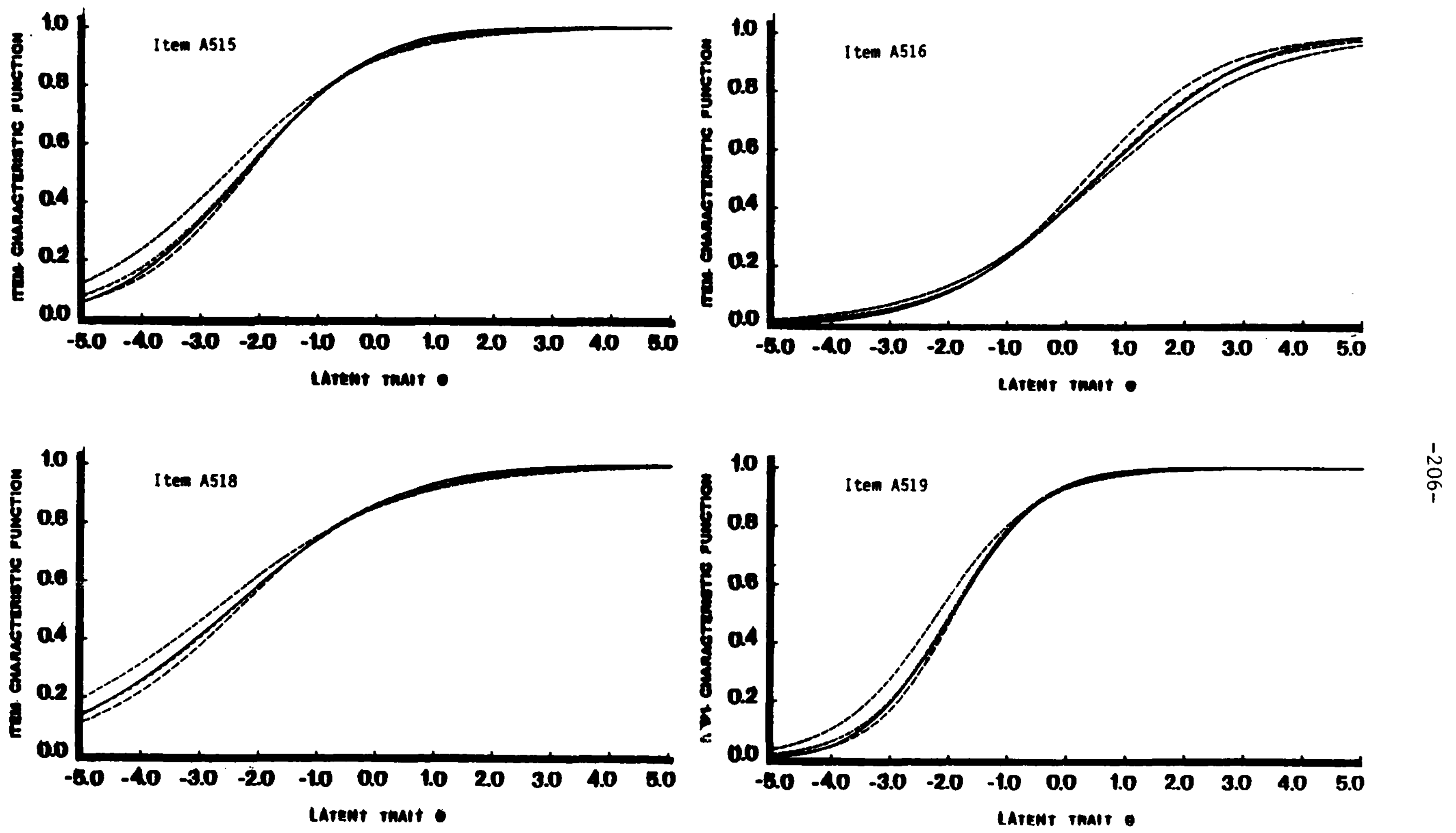


FIGURE 9-1 (Continued)

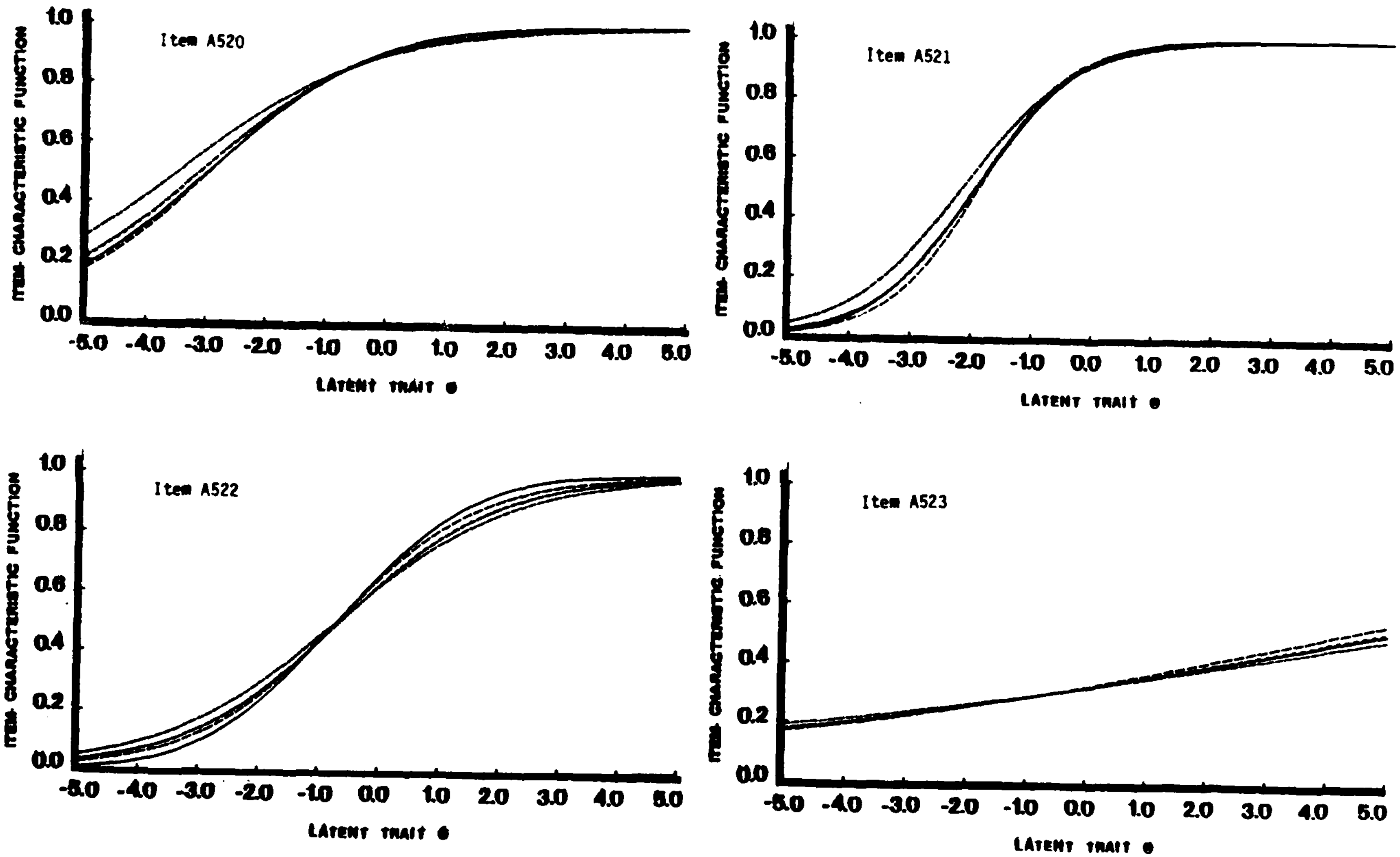


FIGURE 9-1 (Continued)

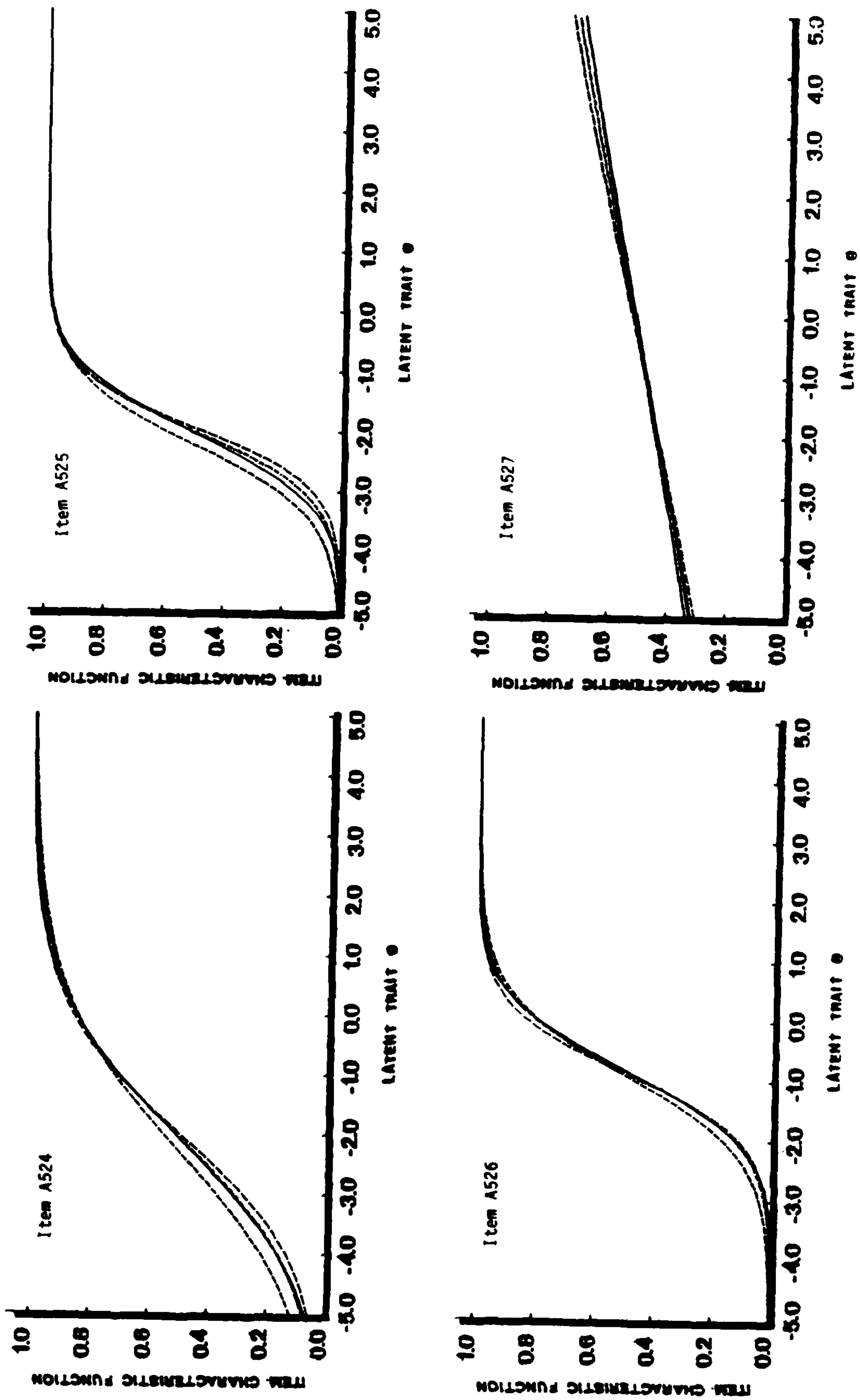


FIGURE 9-1 (Continued)

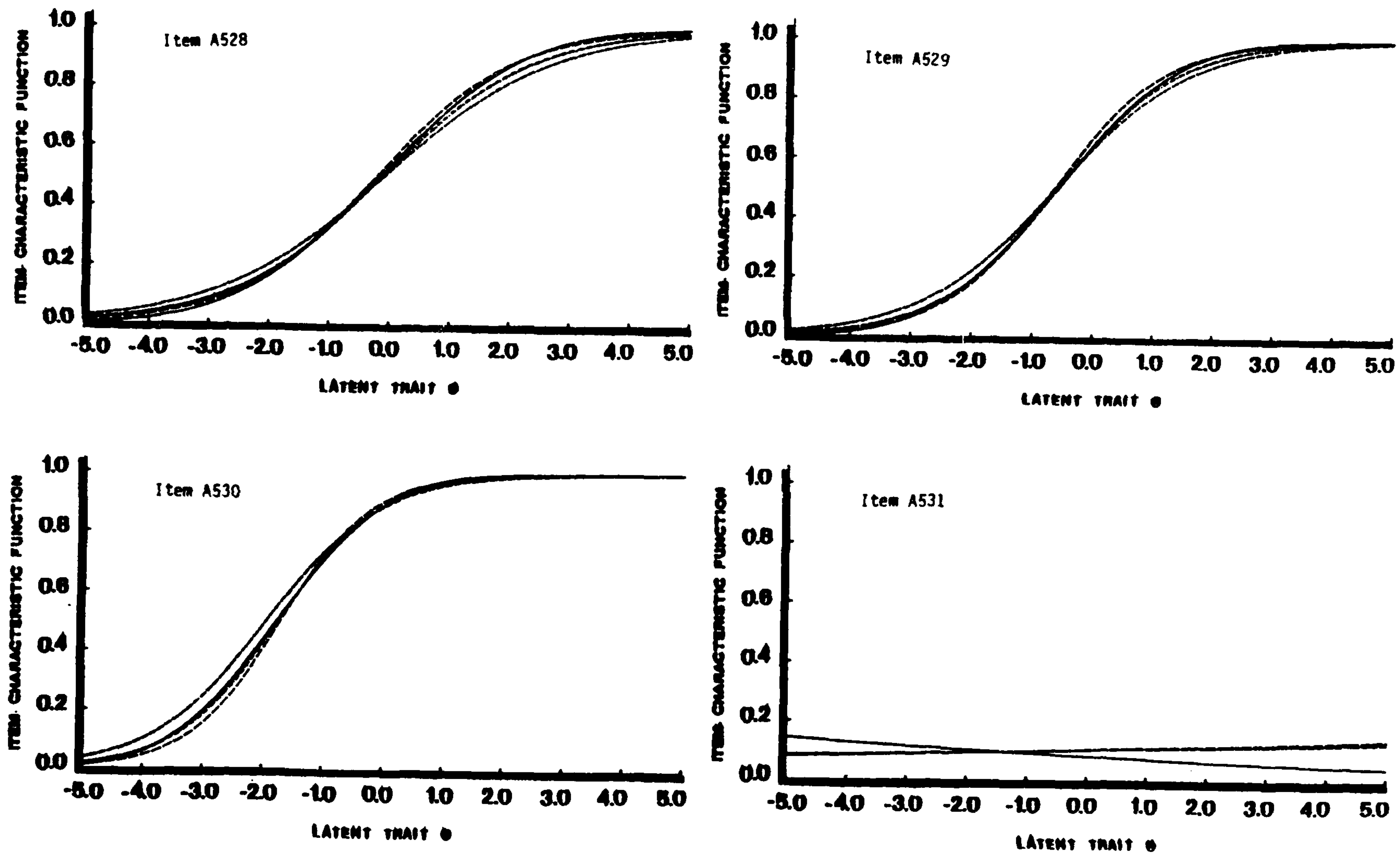


FIGURE 9-1 (Continued)

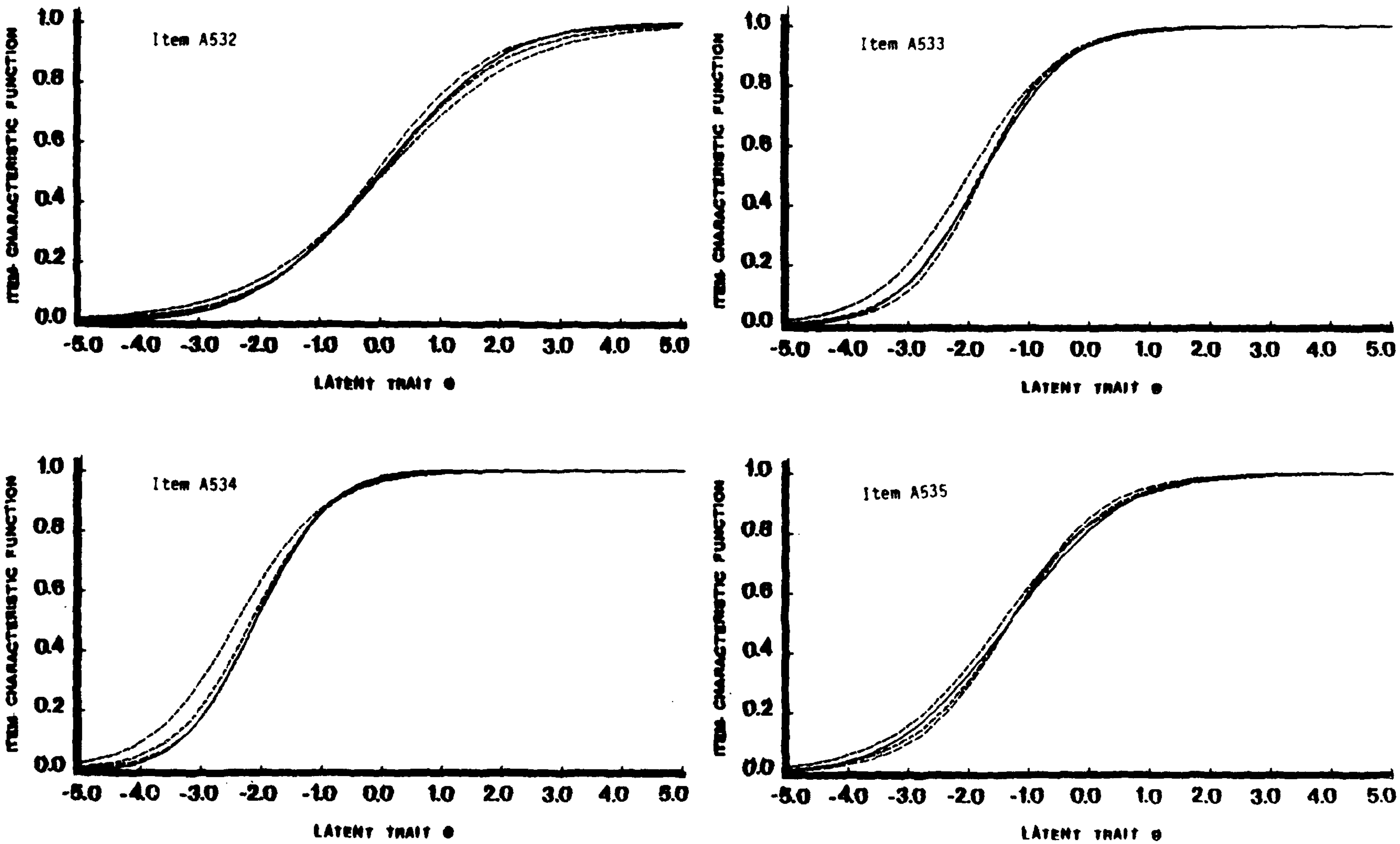


FIGURE 9-1 (Continued)

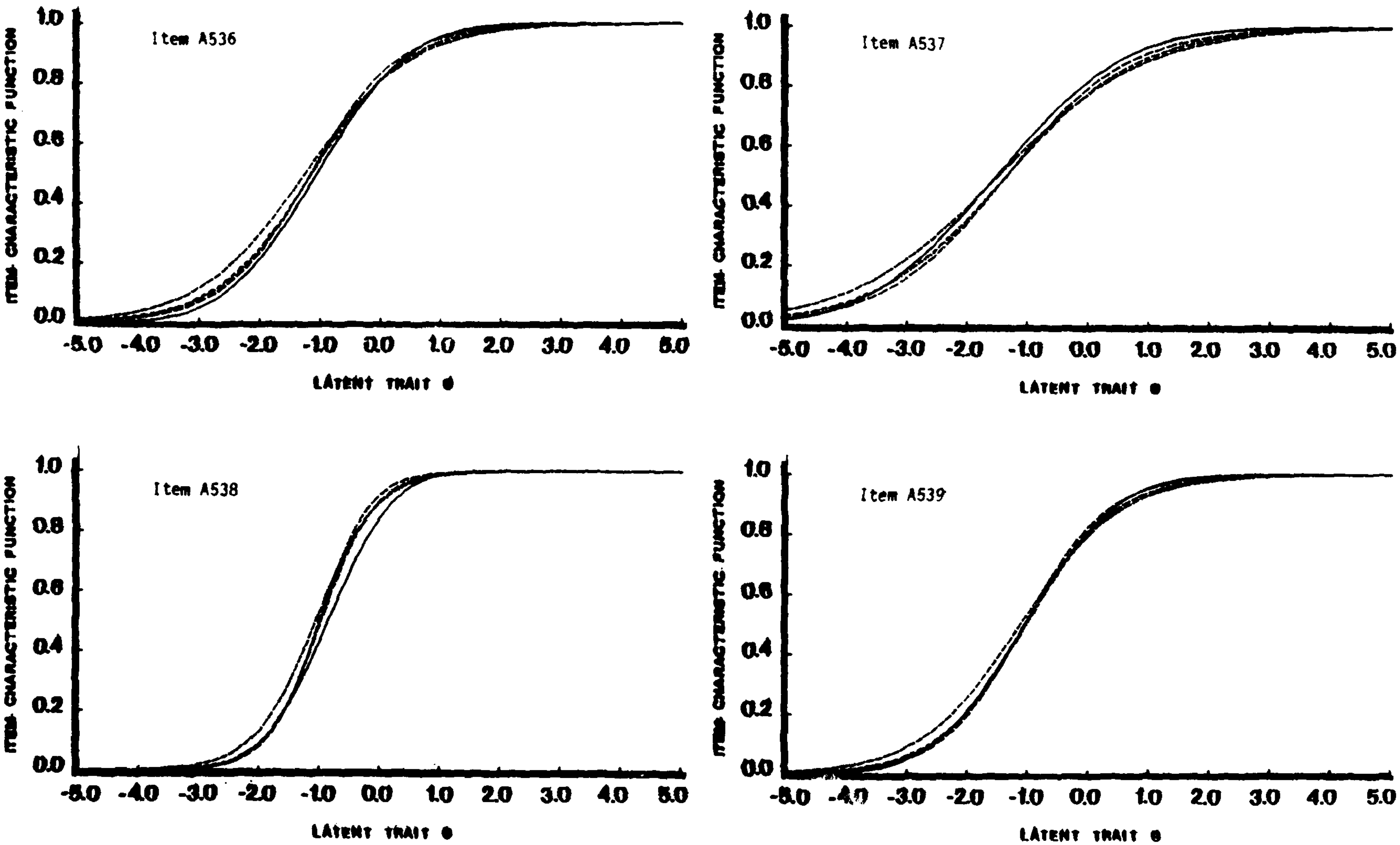


FIGURE 9-1 (Continued)

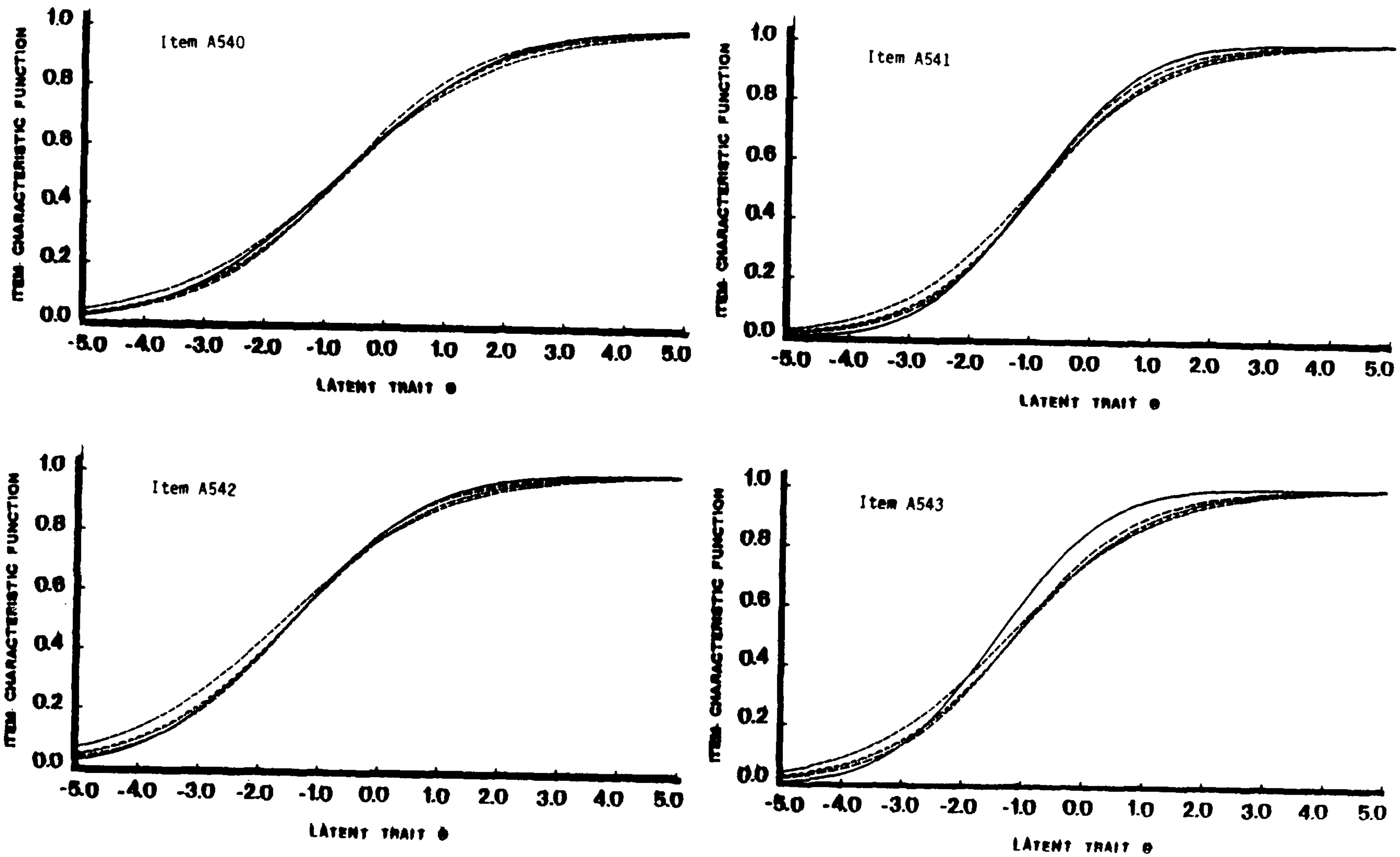


FIGURE 9-1 (Continued)

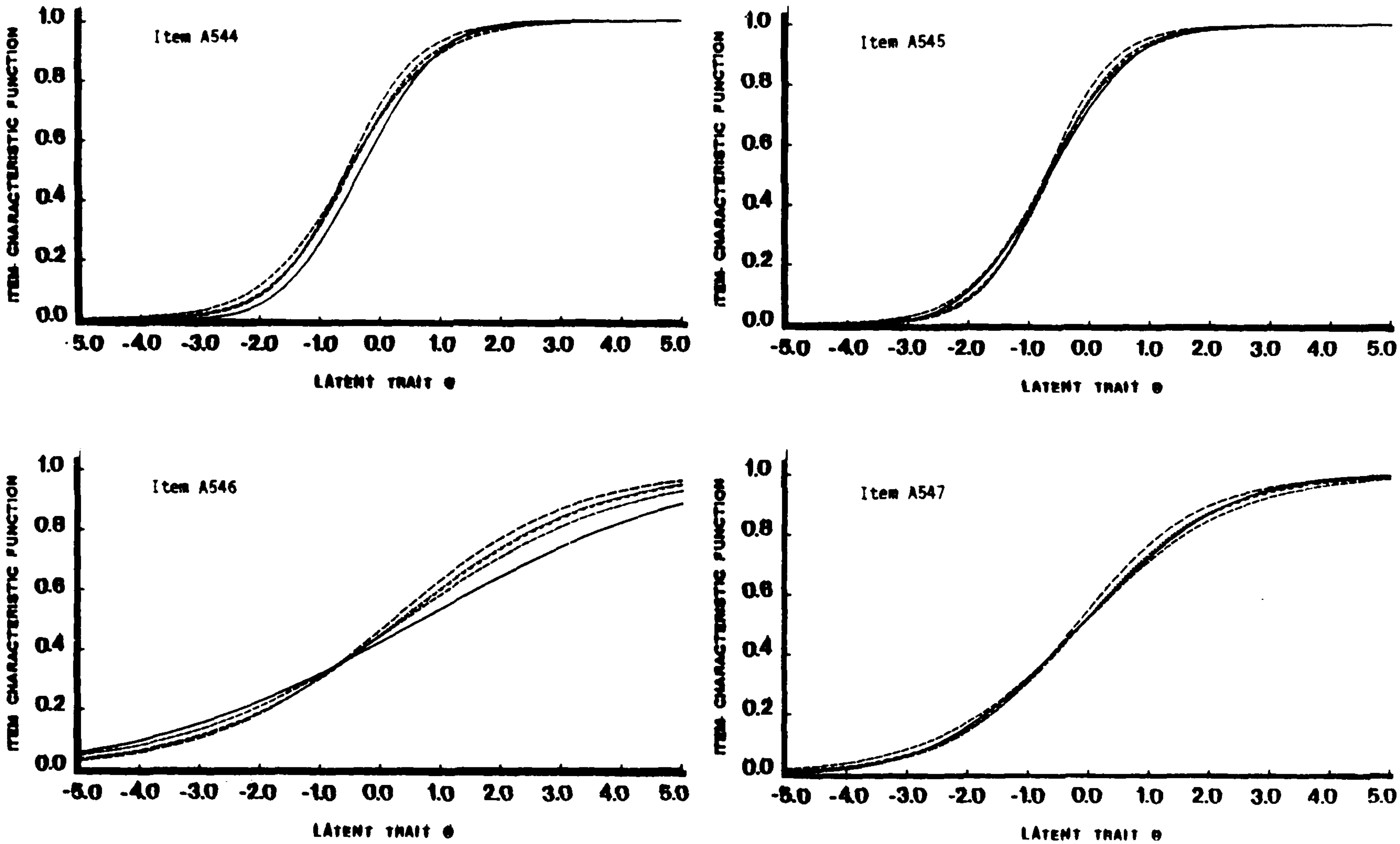


FIGURE 9-1 (Continued)

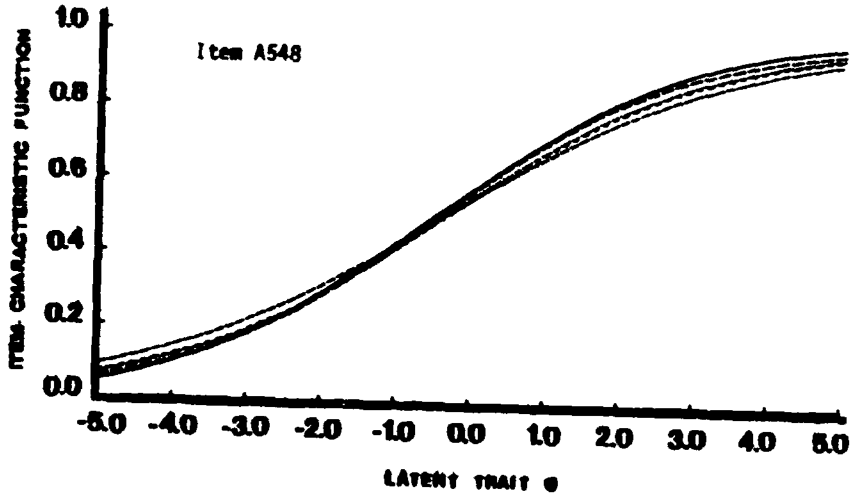


FIGURE 9-1 (Continued)

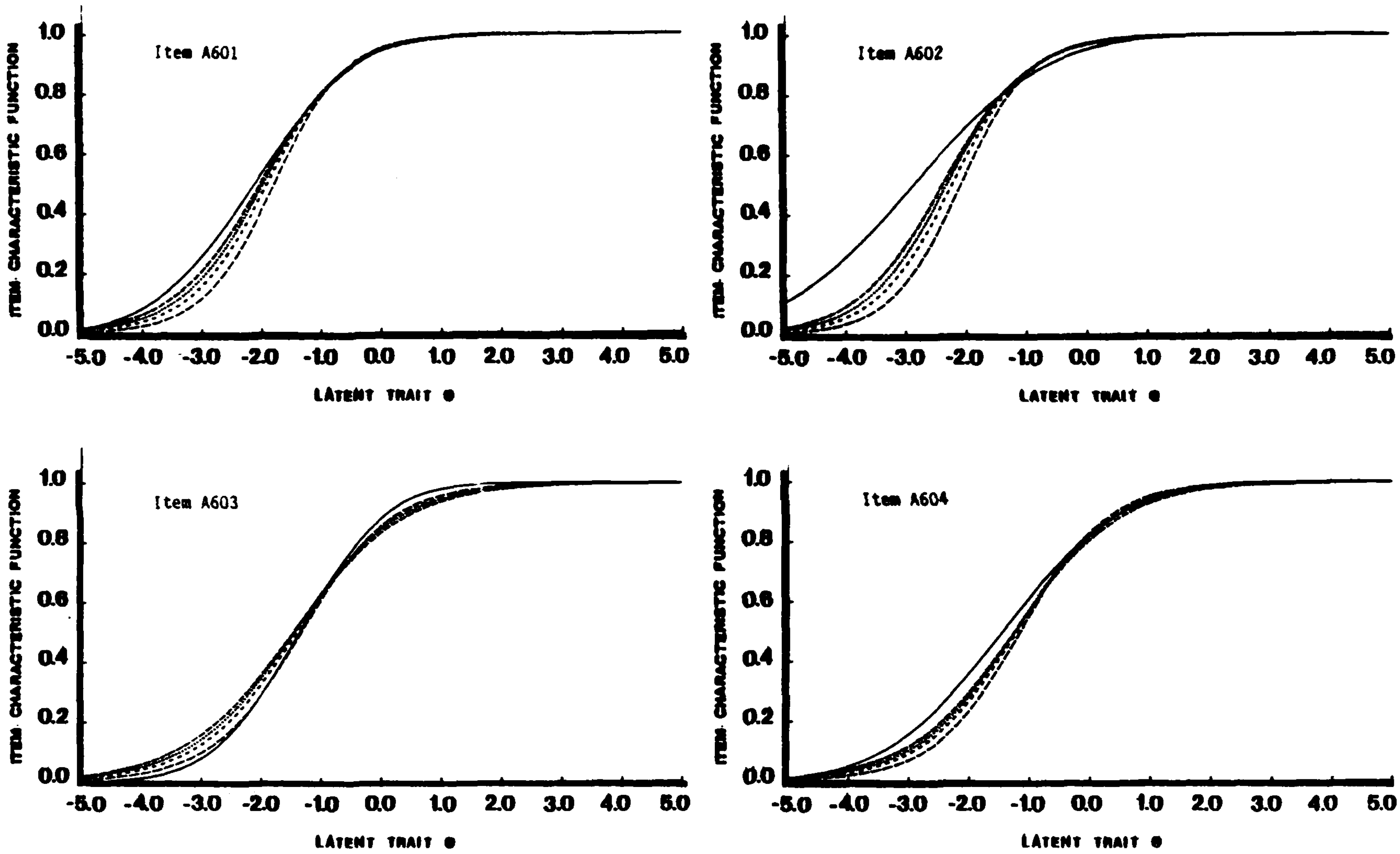


FIGURE 9-2

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the A5-A6 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test A6.

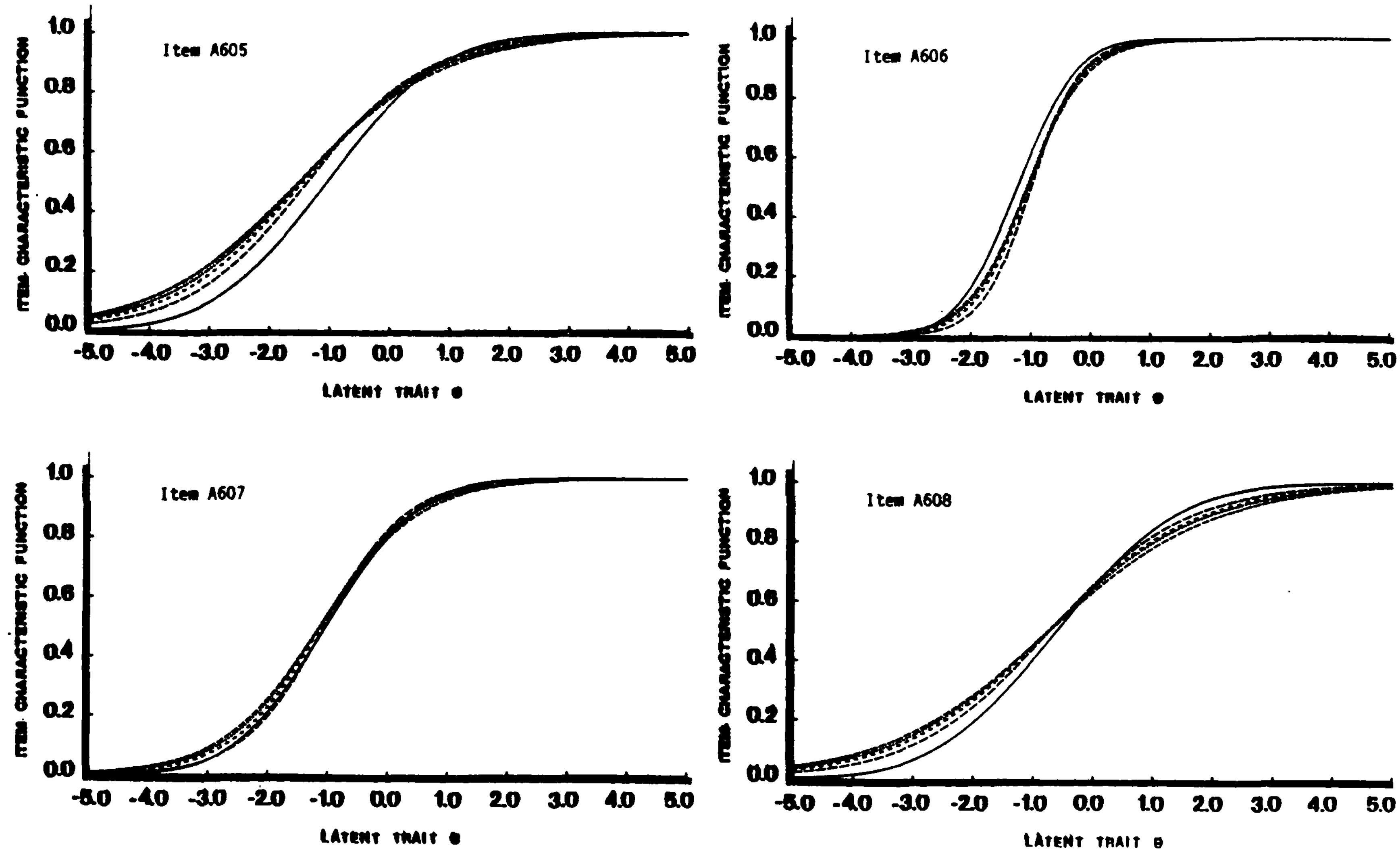


FIGURE 9-2 (Continued)

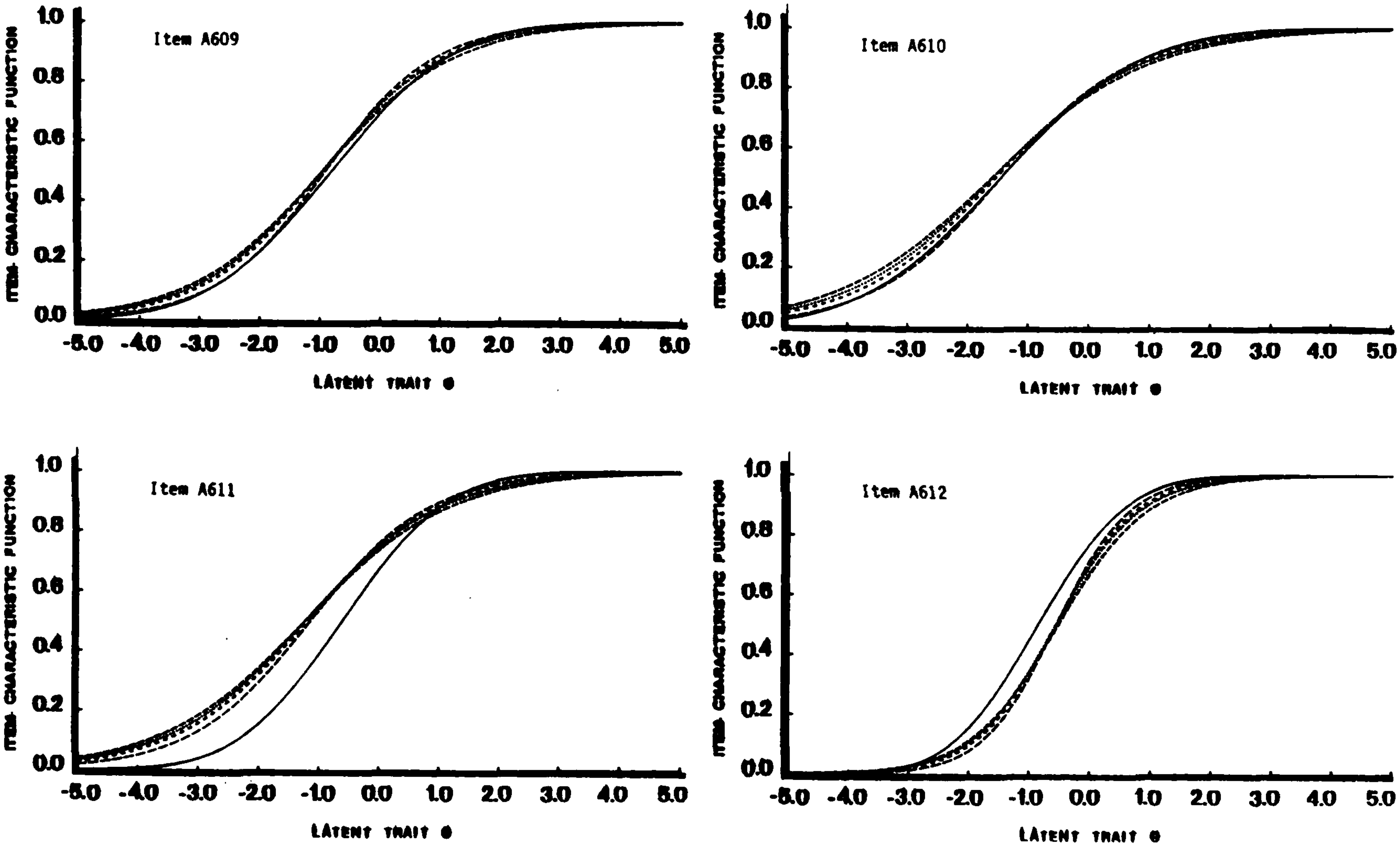


FIGURE 9-2 (Continued)

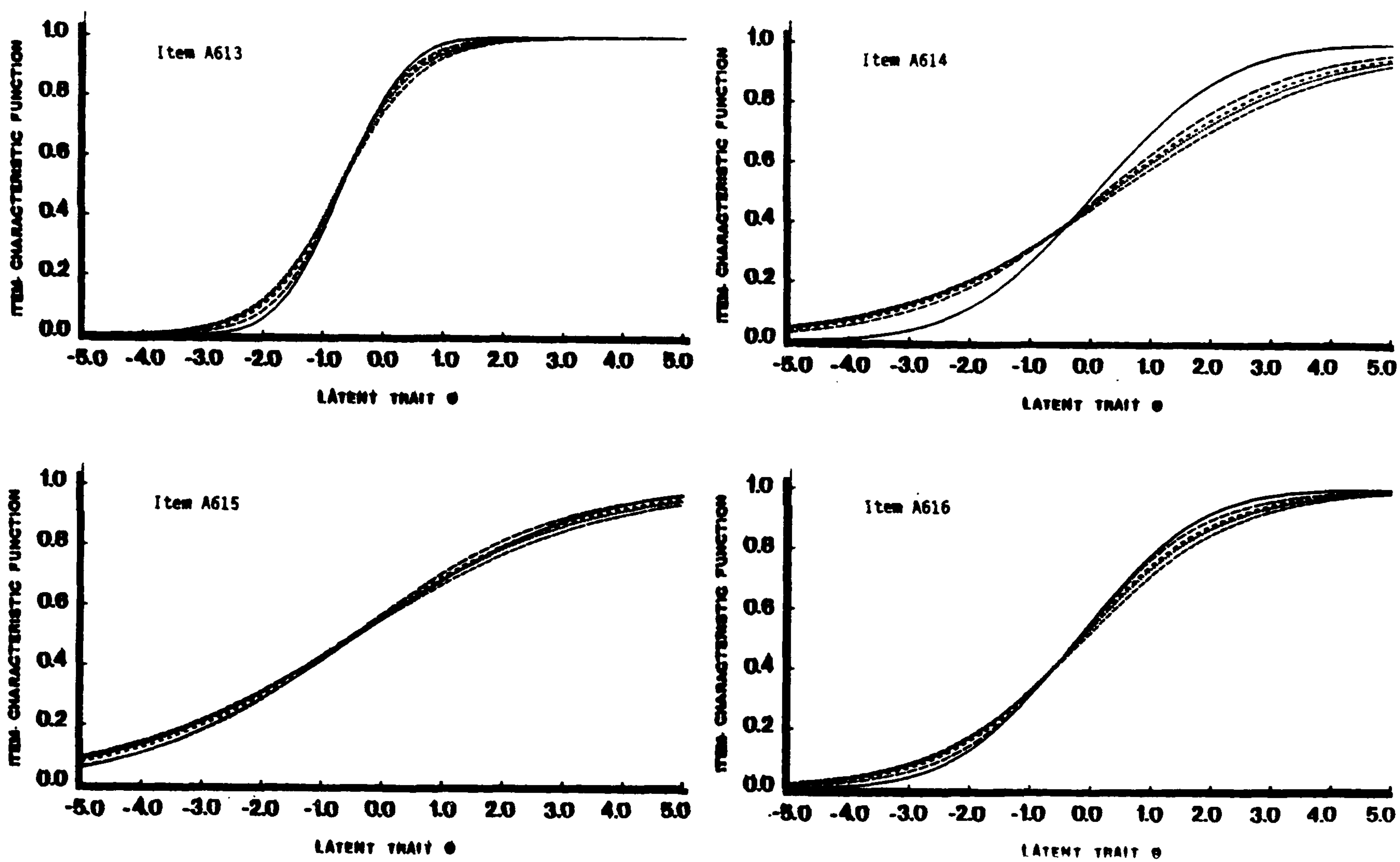


FIGURE 9-2 (Continued)

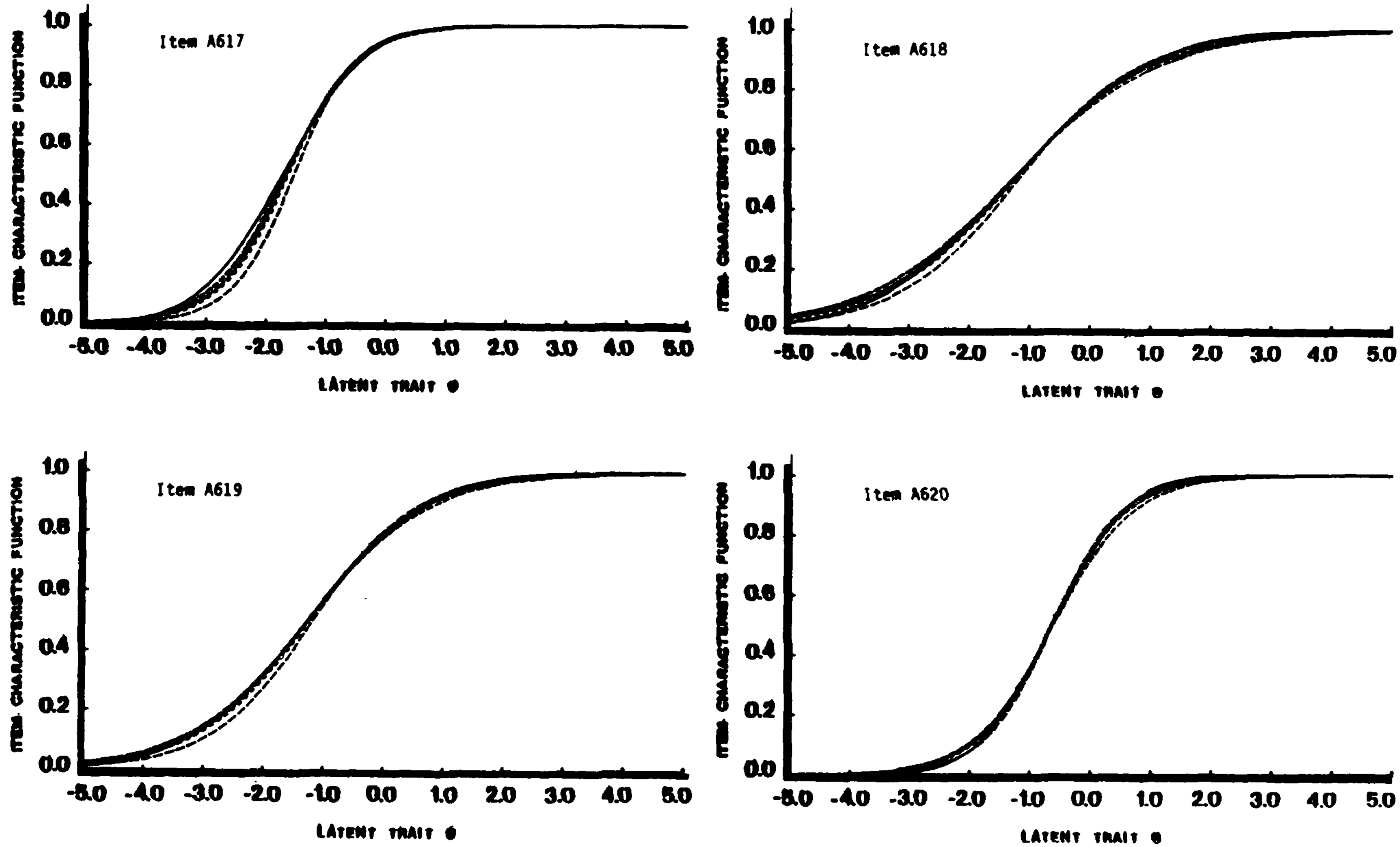


FIGURE 9-2 (Continued)

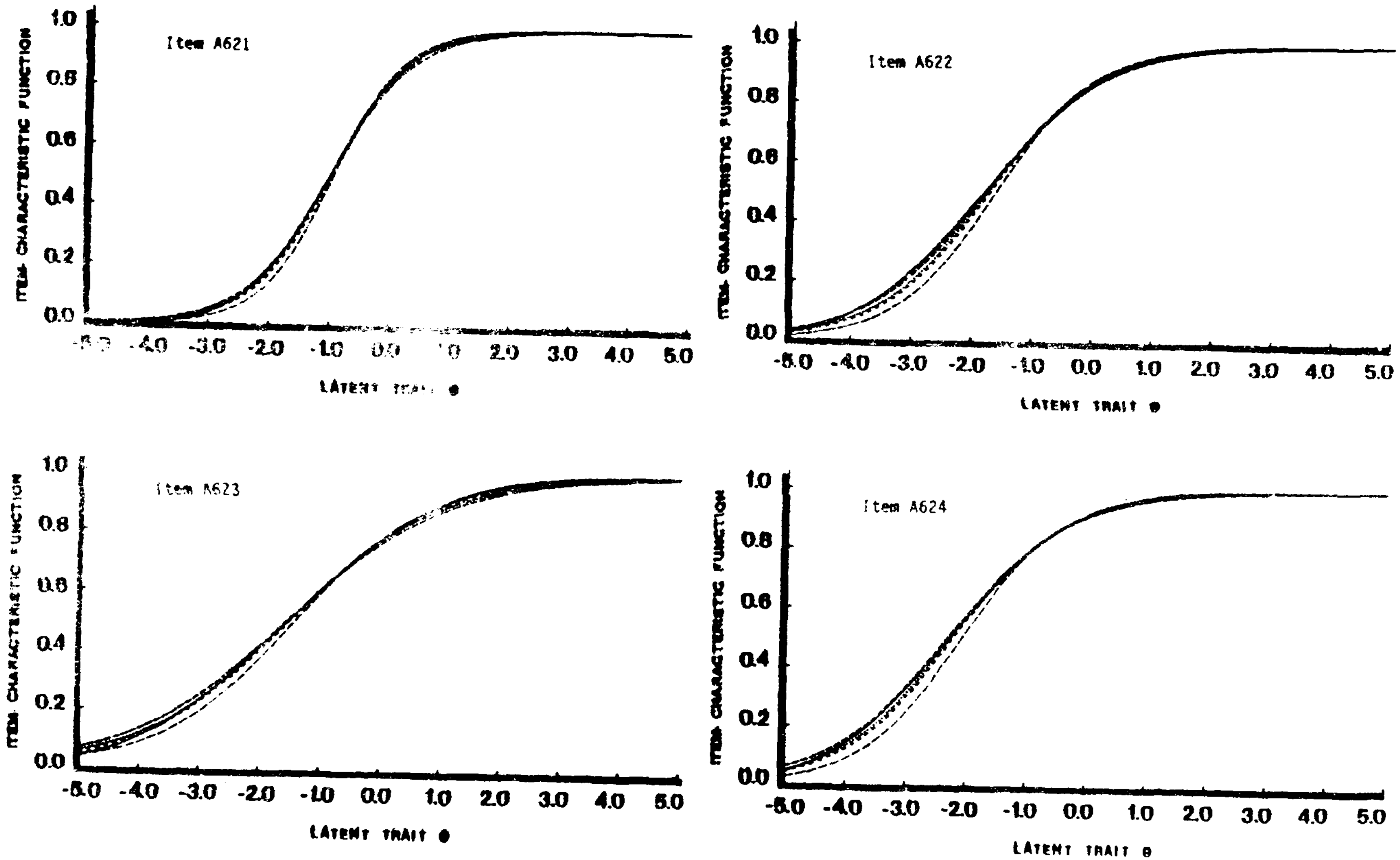


FIGURE 9-2 (Continued)

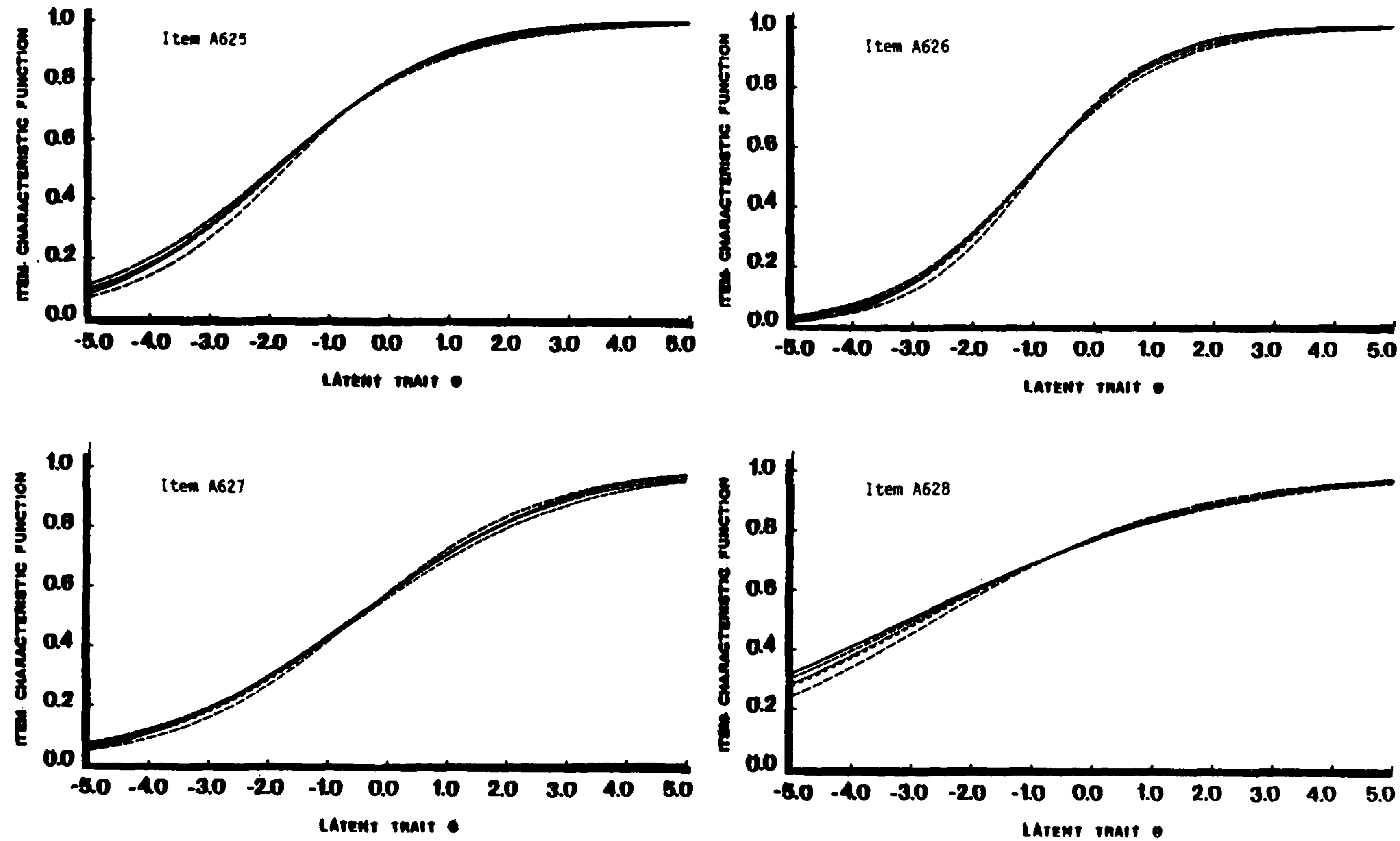


FIGURE 9-2 (Continued)

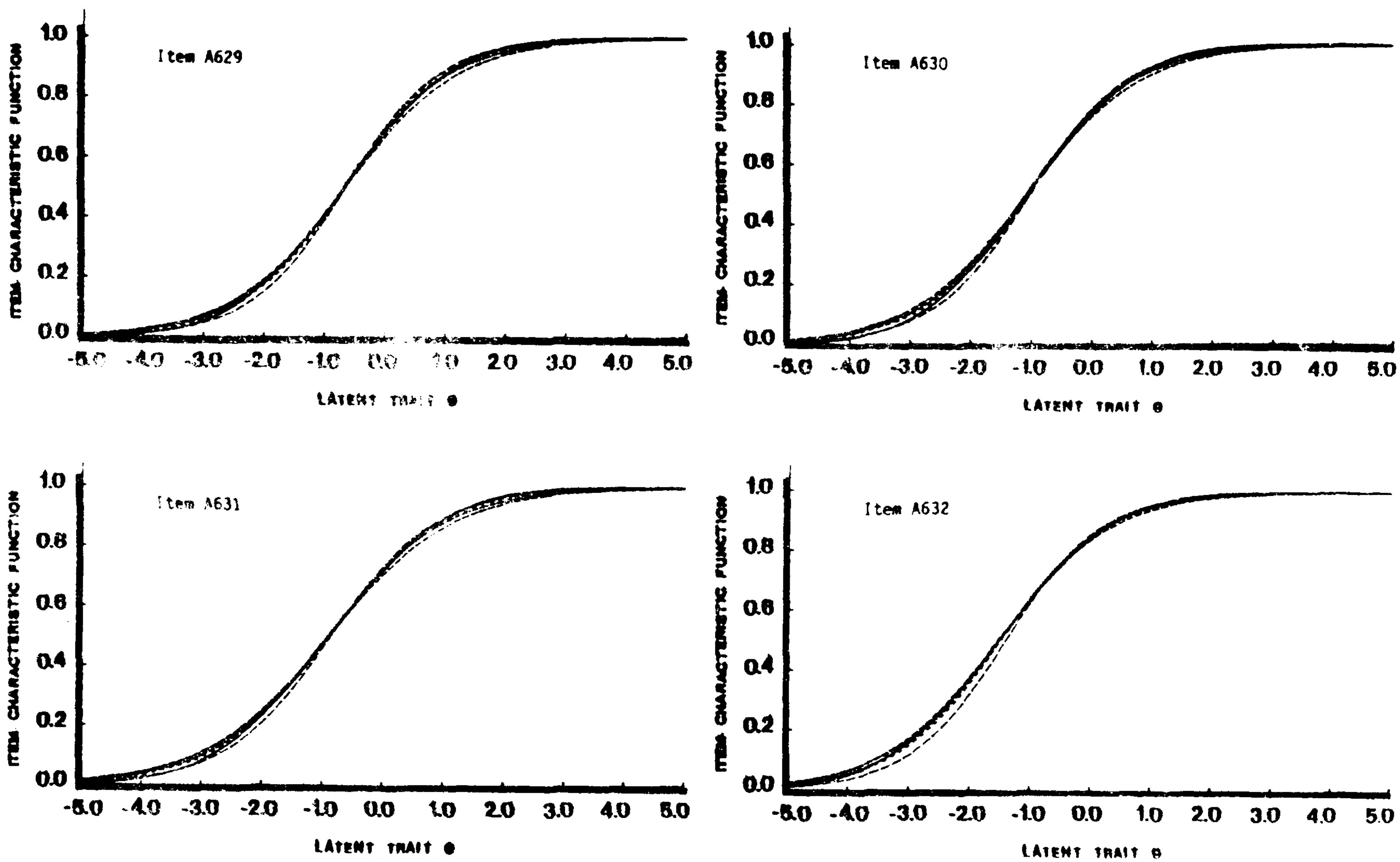


FIGURE 9-2 (Continued)

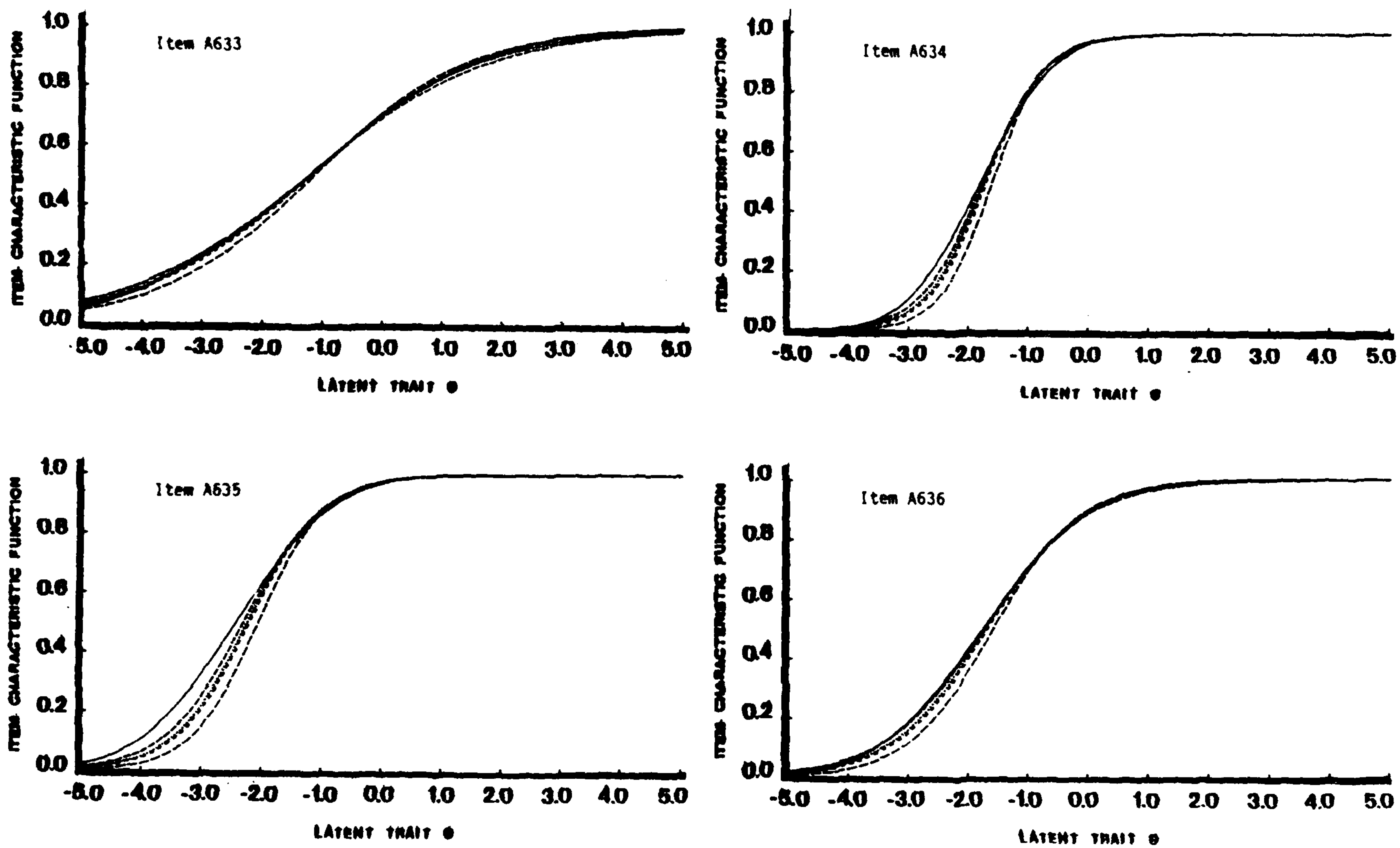


FIGURE 9-2 (Continued)

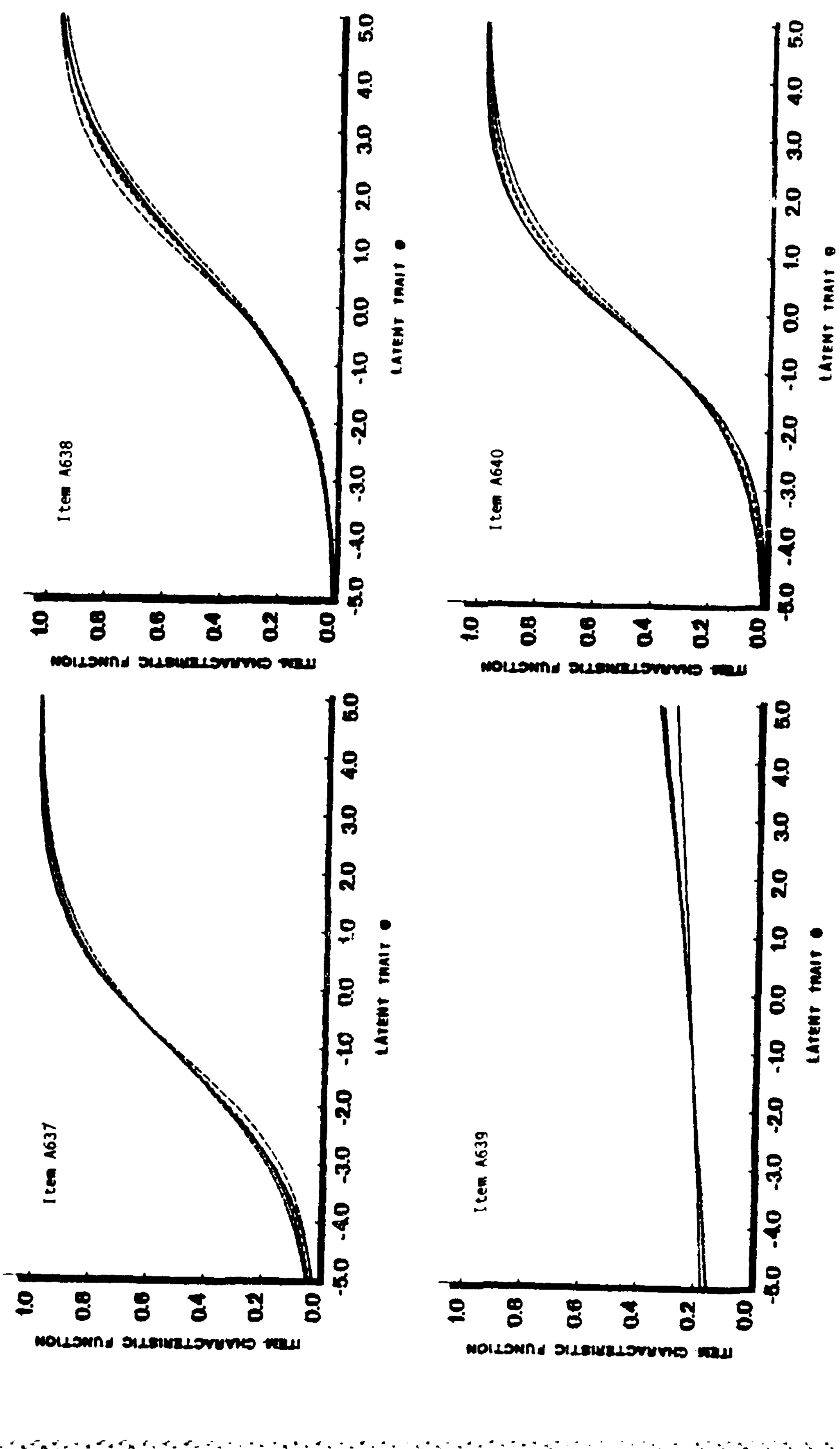
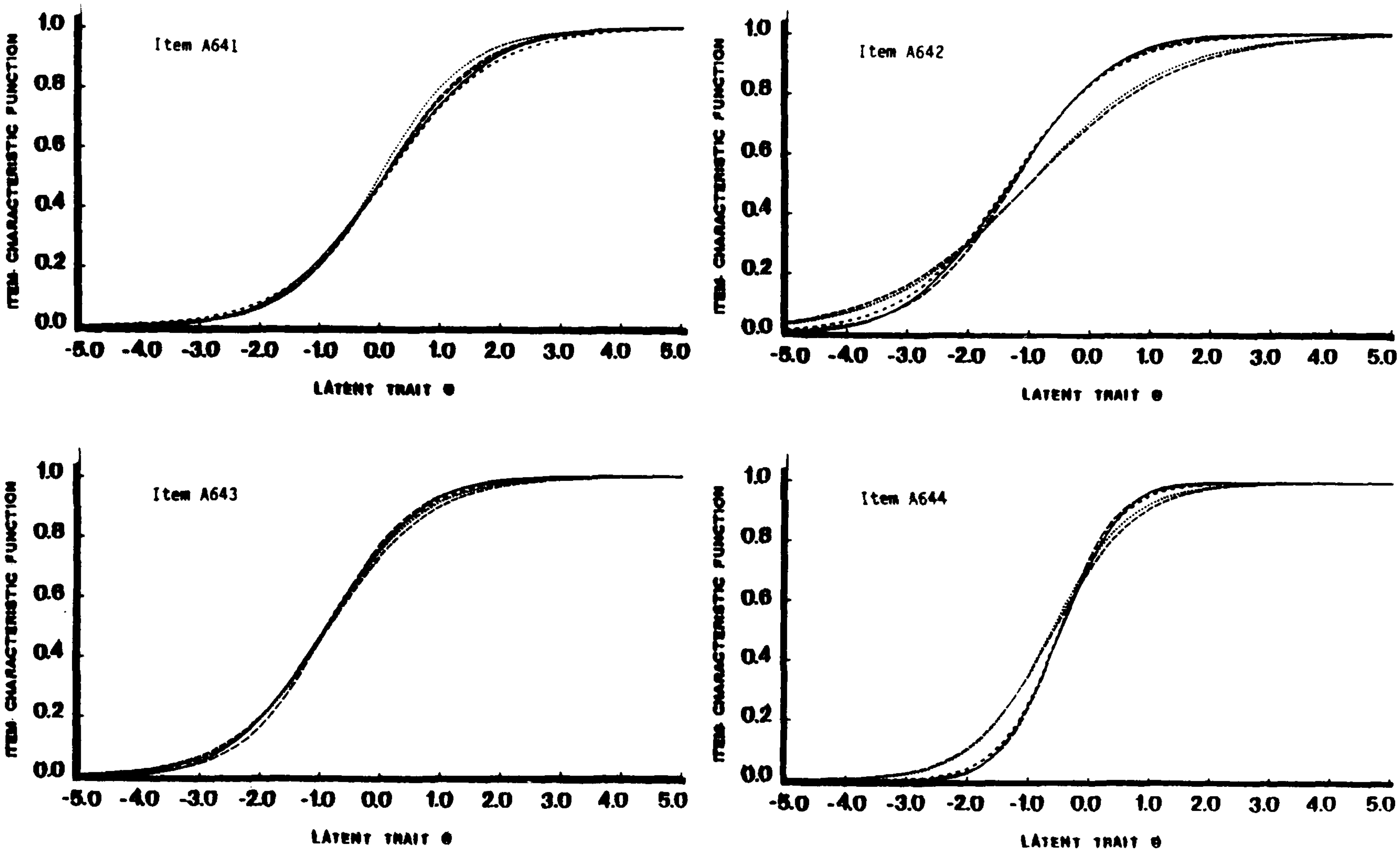


FIGURE 9-2 (Continued)



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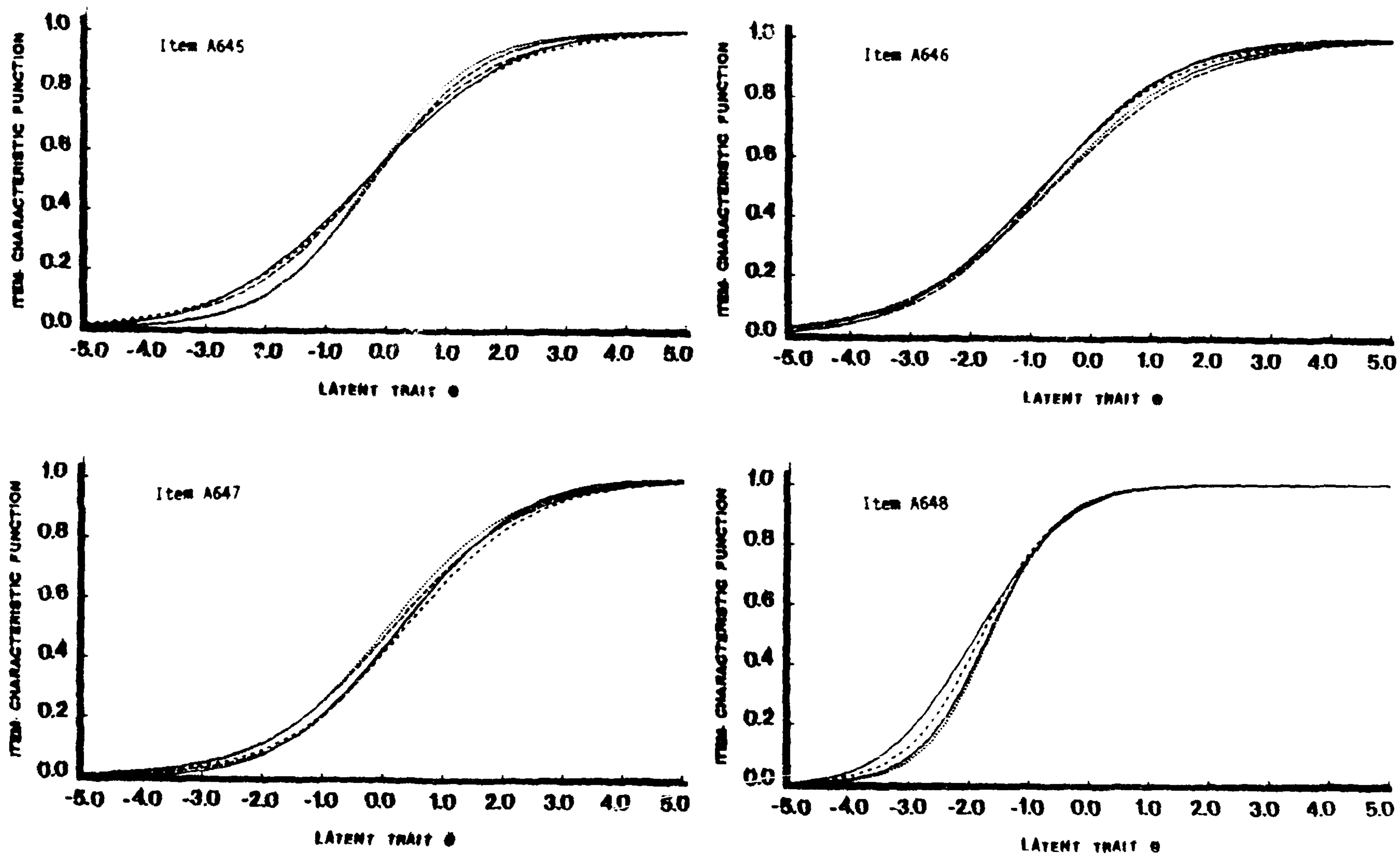

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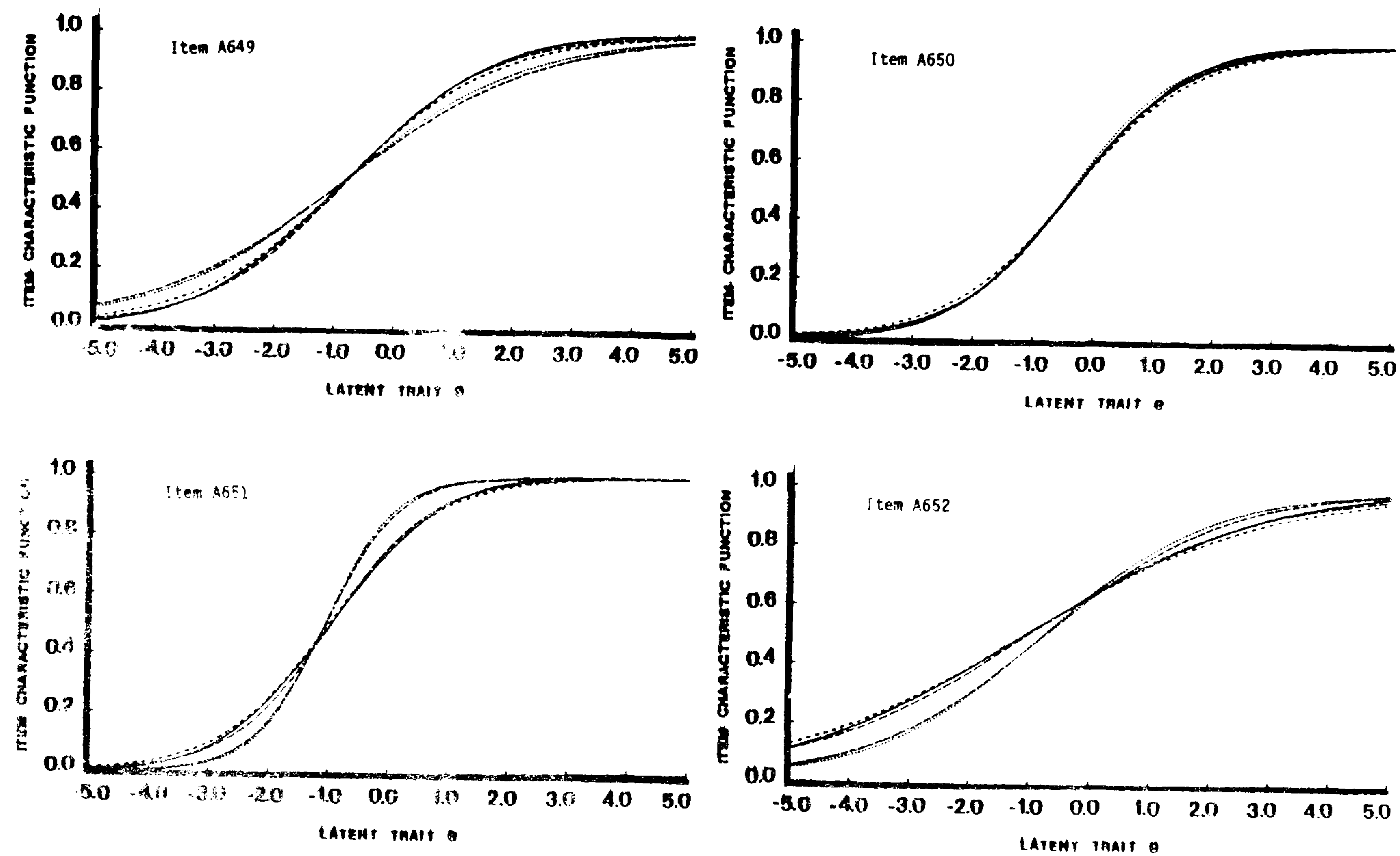

FIGURE 9-2 (Continued)

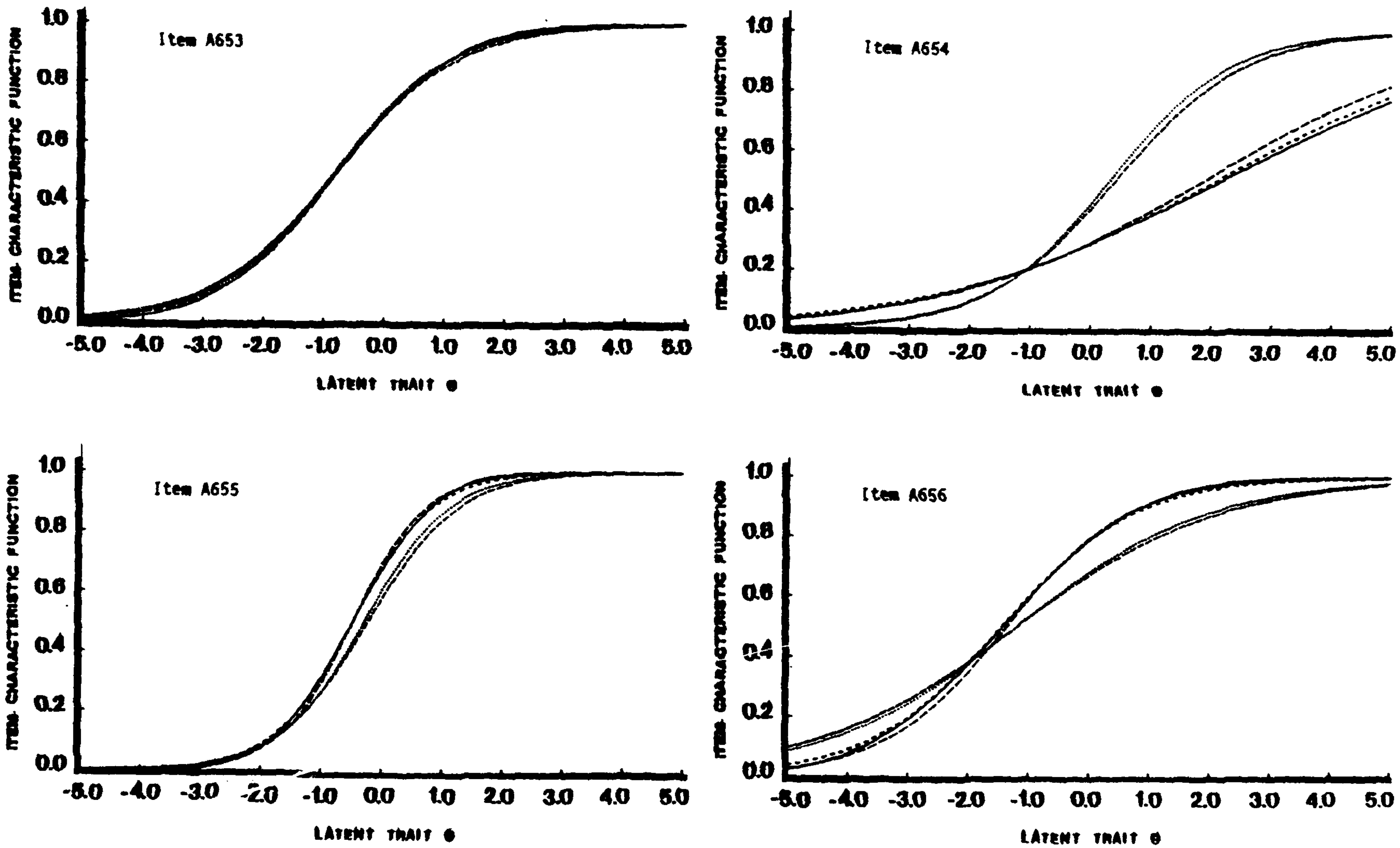

FIGURE 9-2 (Continued)

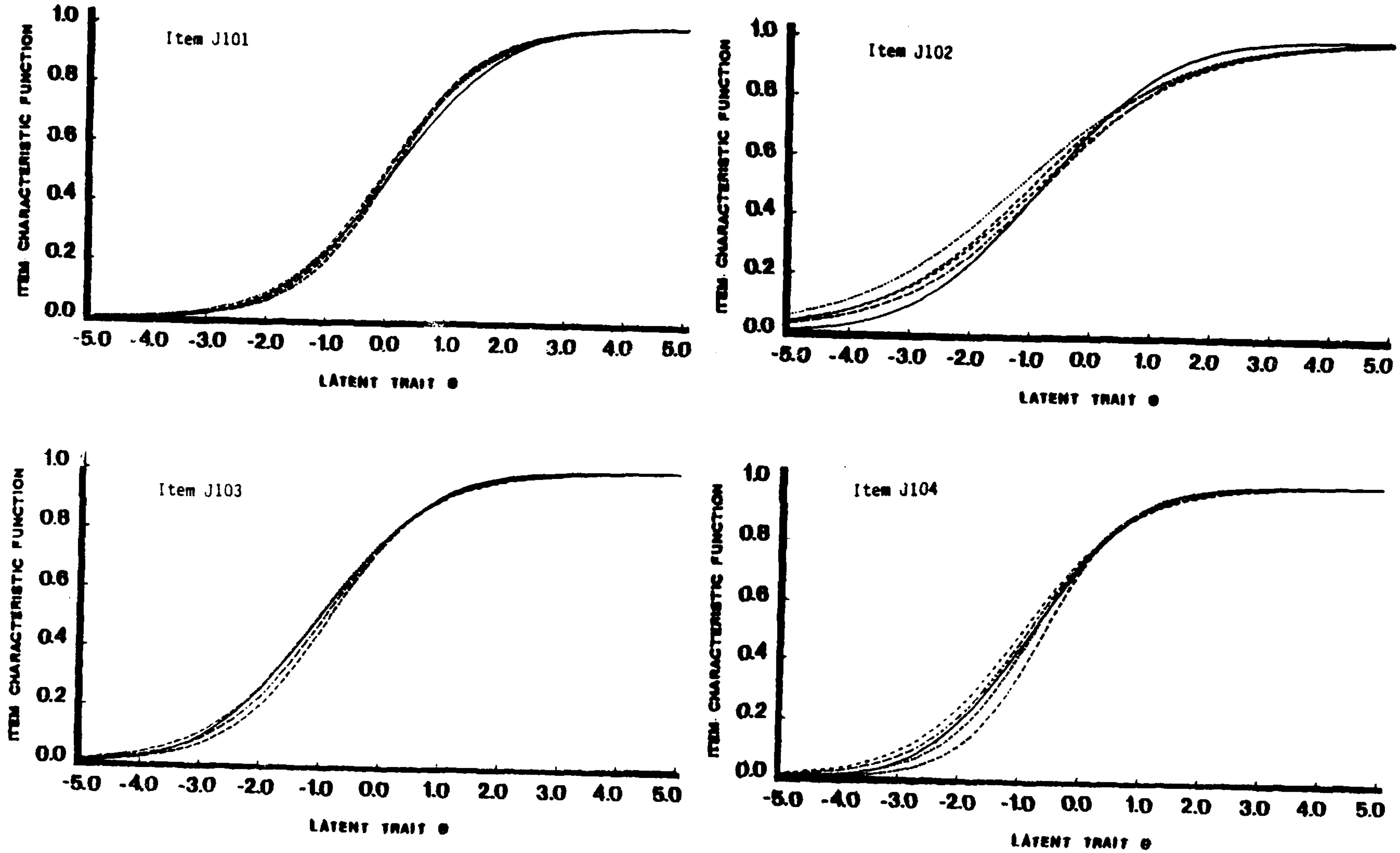

FIGURE 9-3

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the J1-J2 Case Based upon the *First Scale Adjustment (Long Dashed Line)* and the *Second Scale Adjustment (Short Dashed Line)*, And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1.

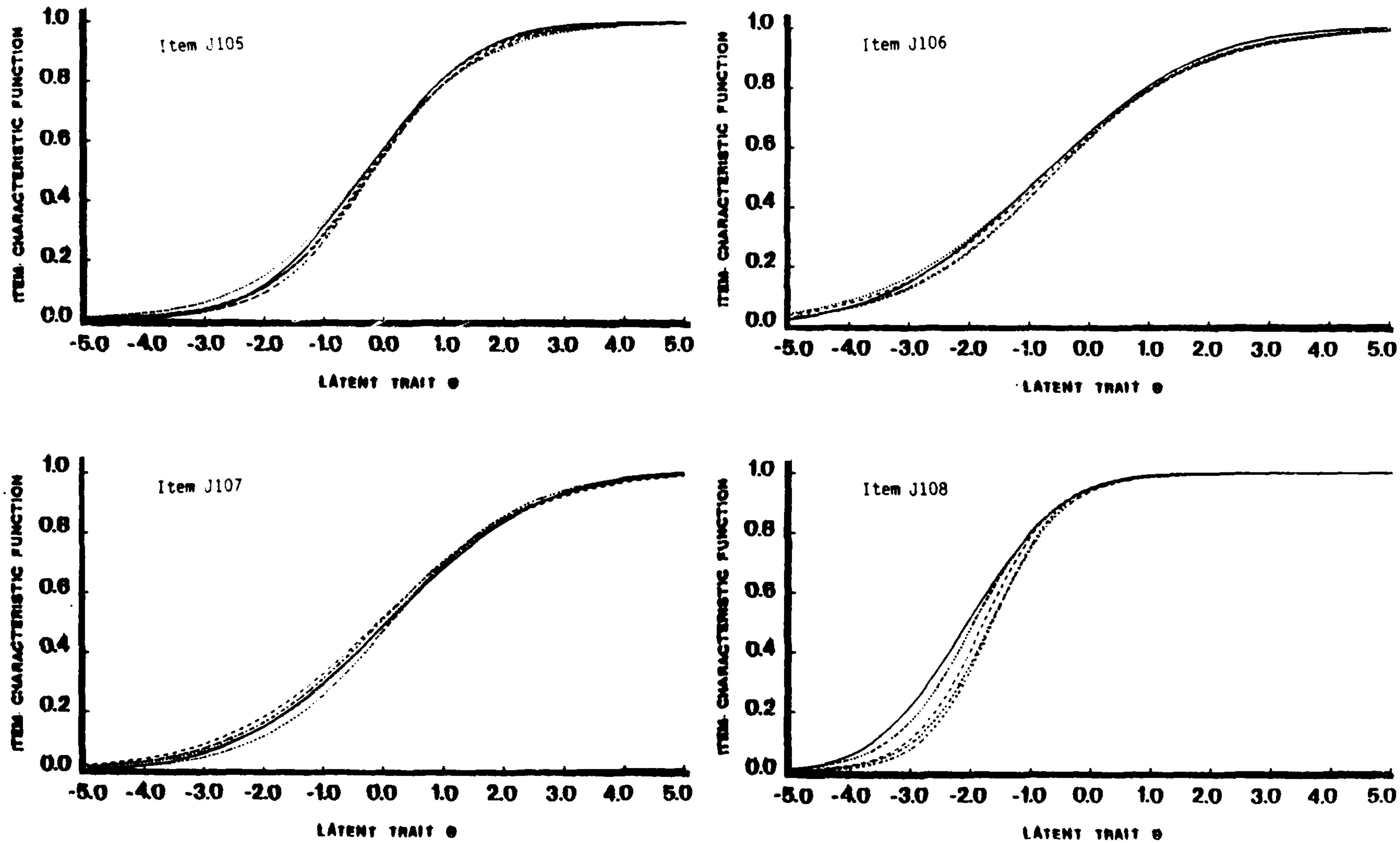

FIGURE 9-3 (Continued)

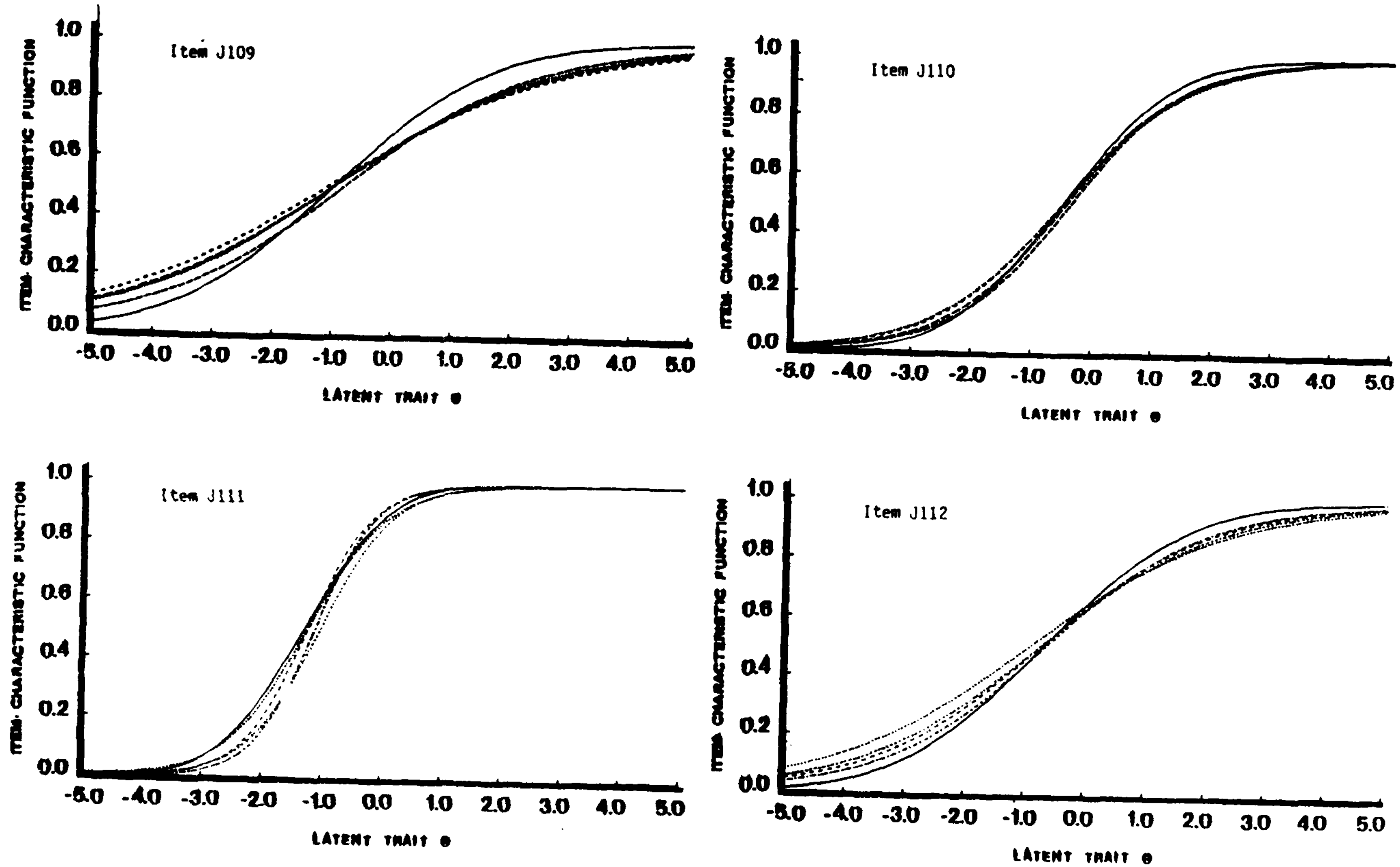

FIGURE 9-3 (Continued)

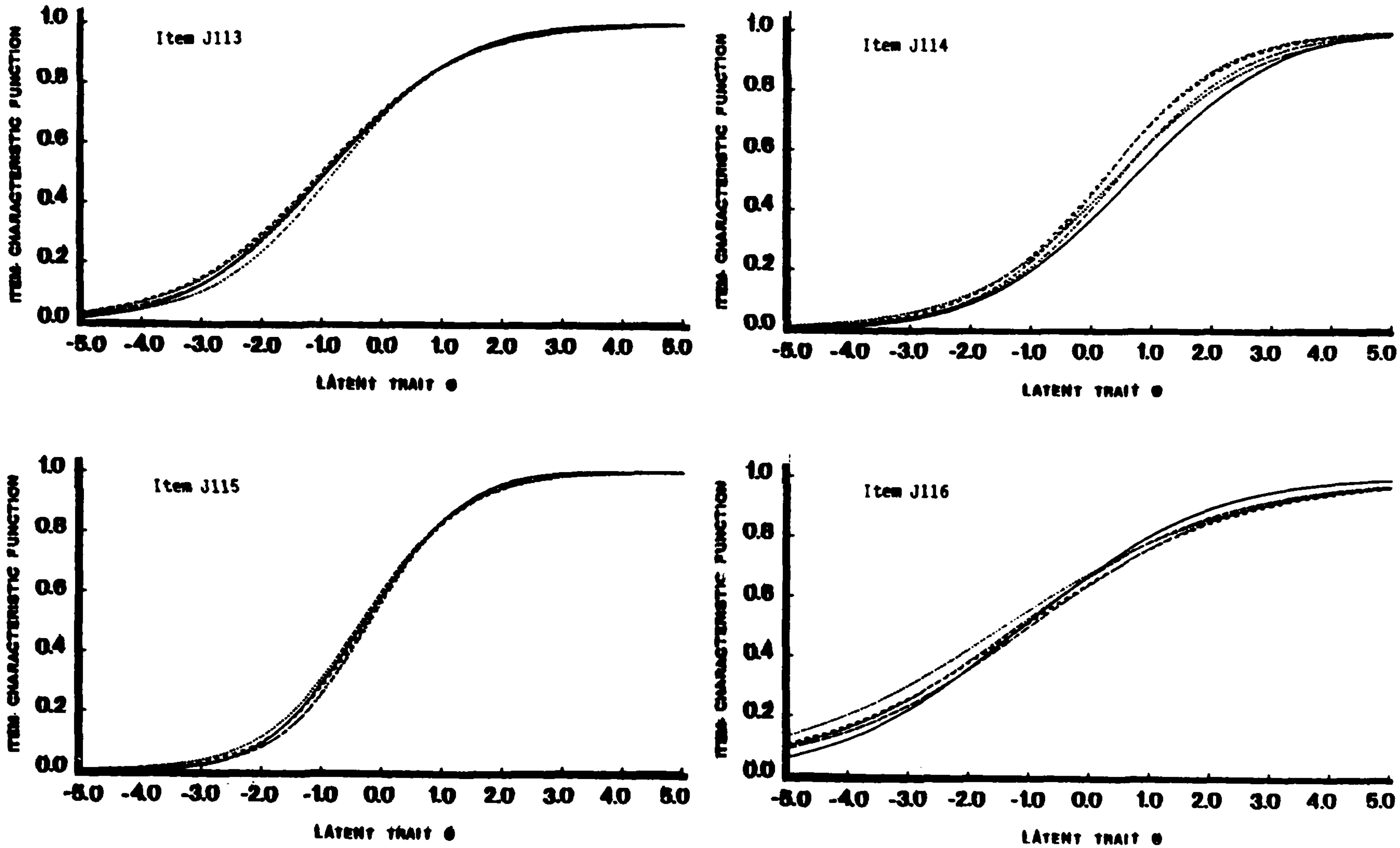

FIGURE 9-3 (Continued)

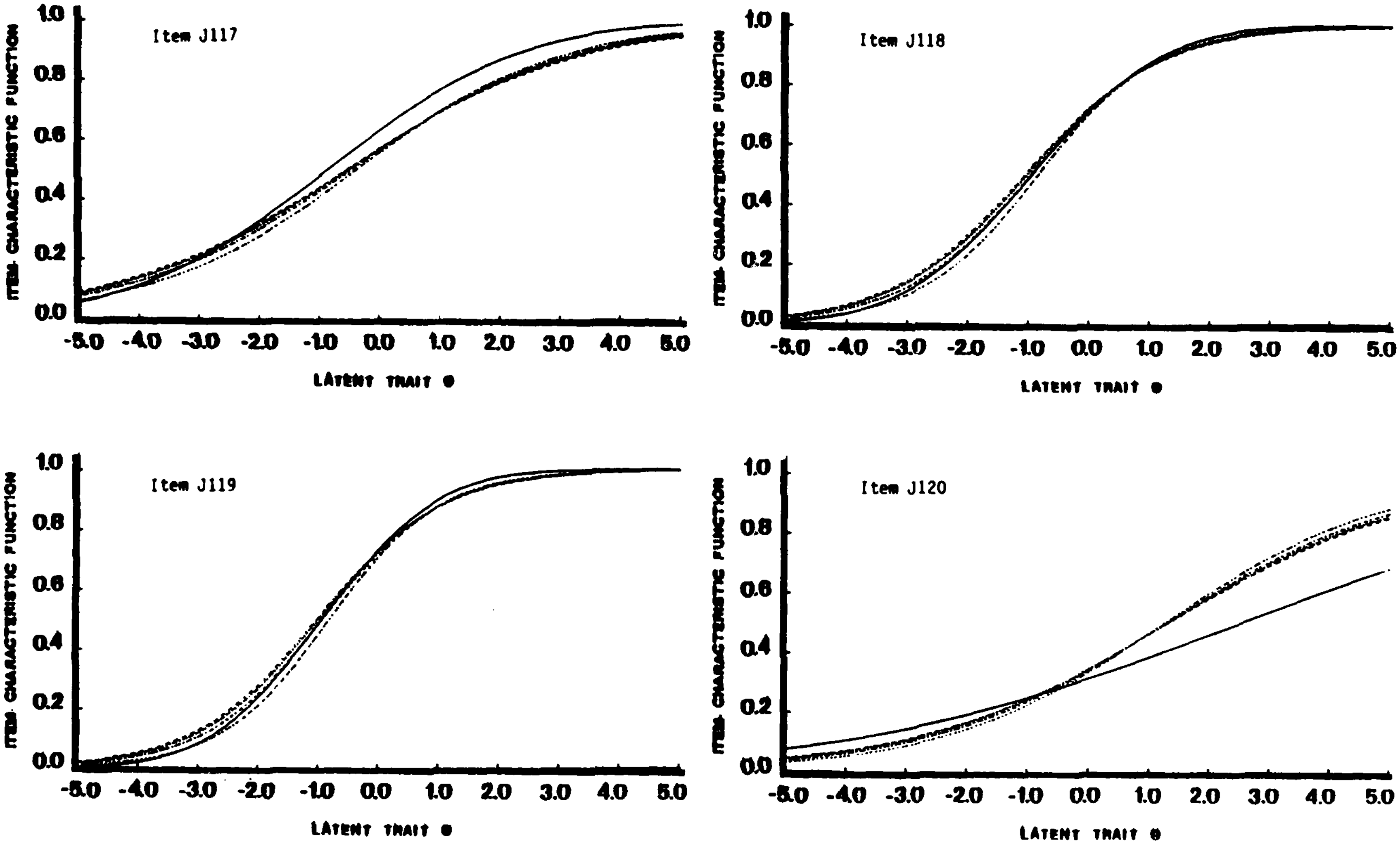

FIGURE 9-3 (Continued)

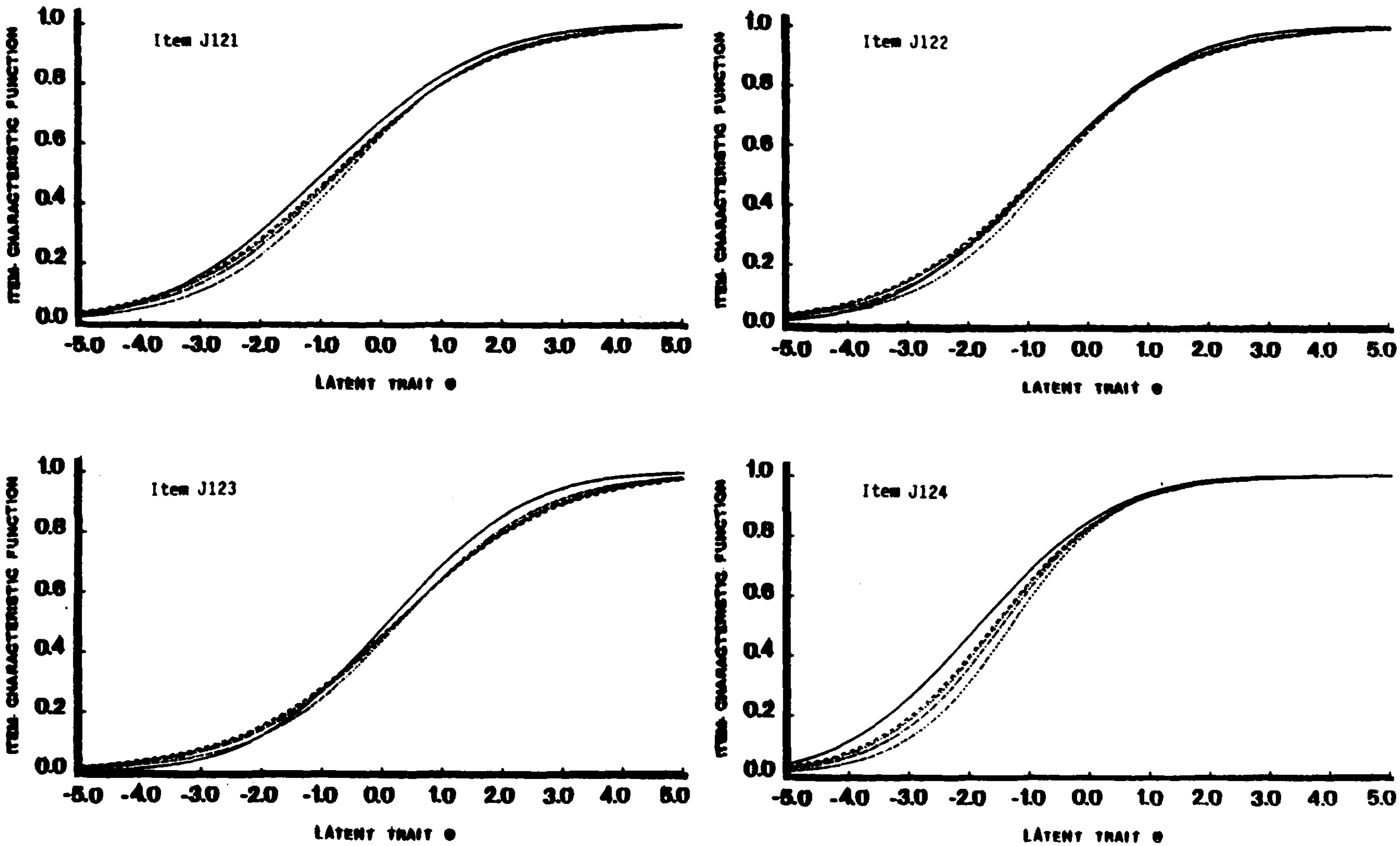

FIGURE 9-3 (Continued)

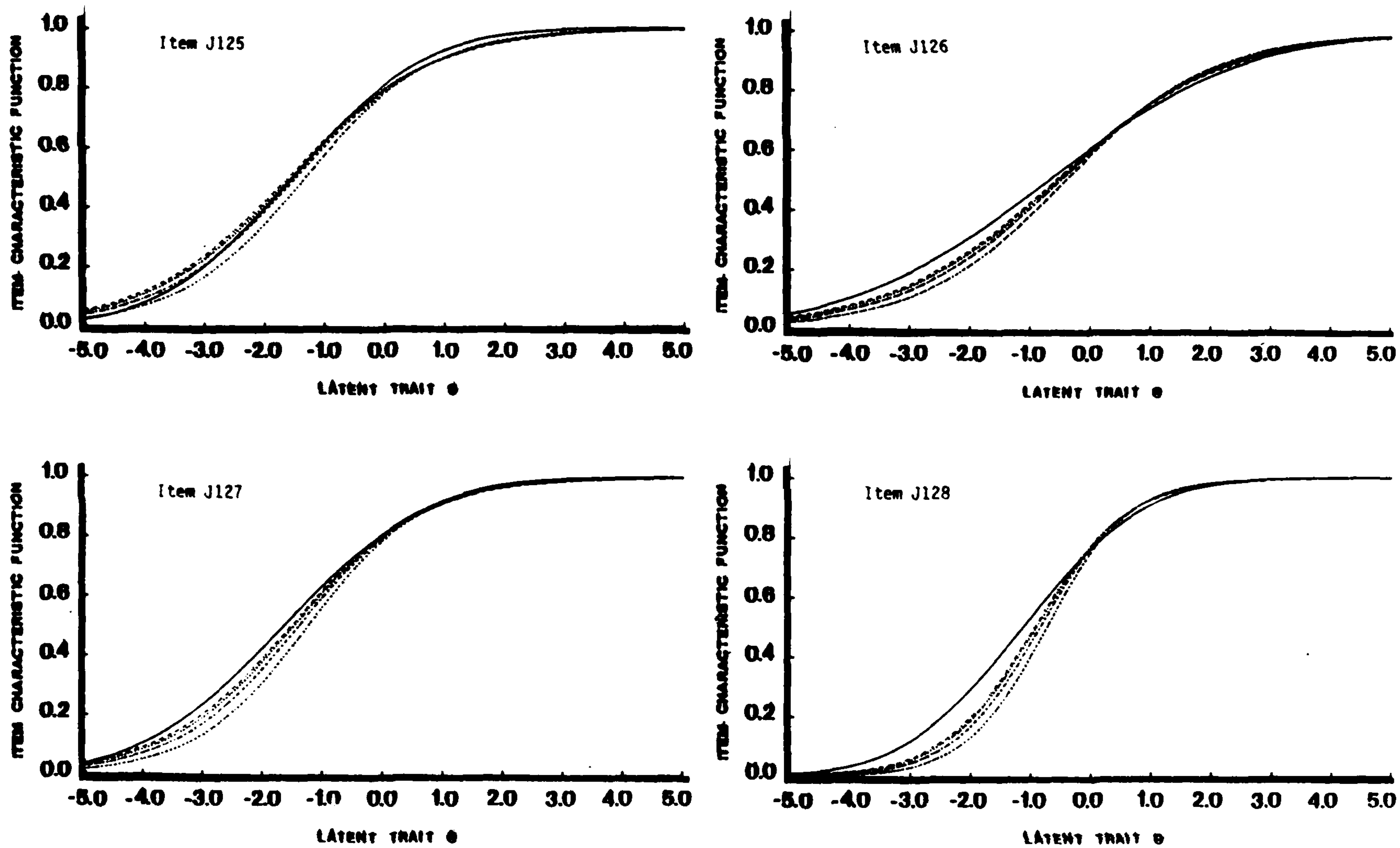

FIGURE 9-3 (Continued)

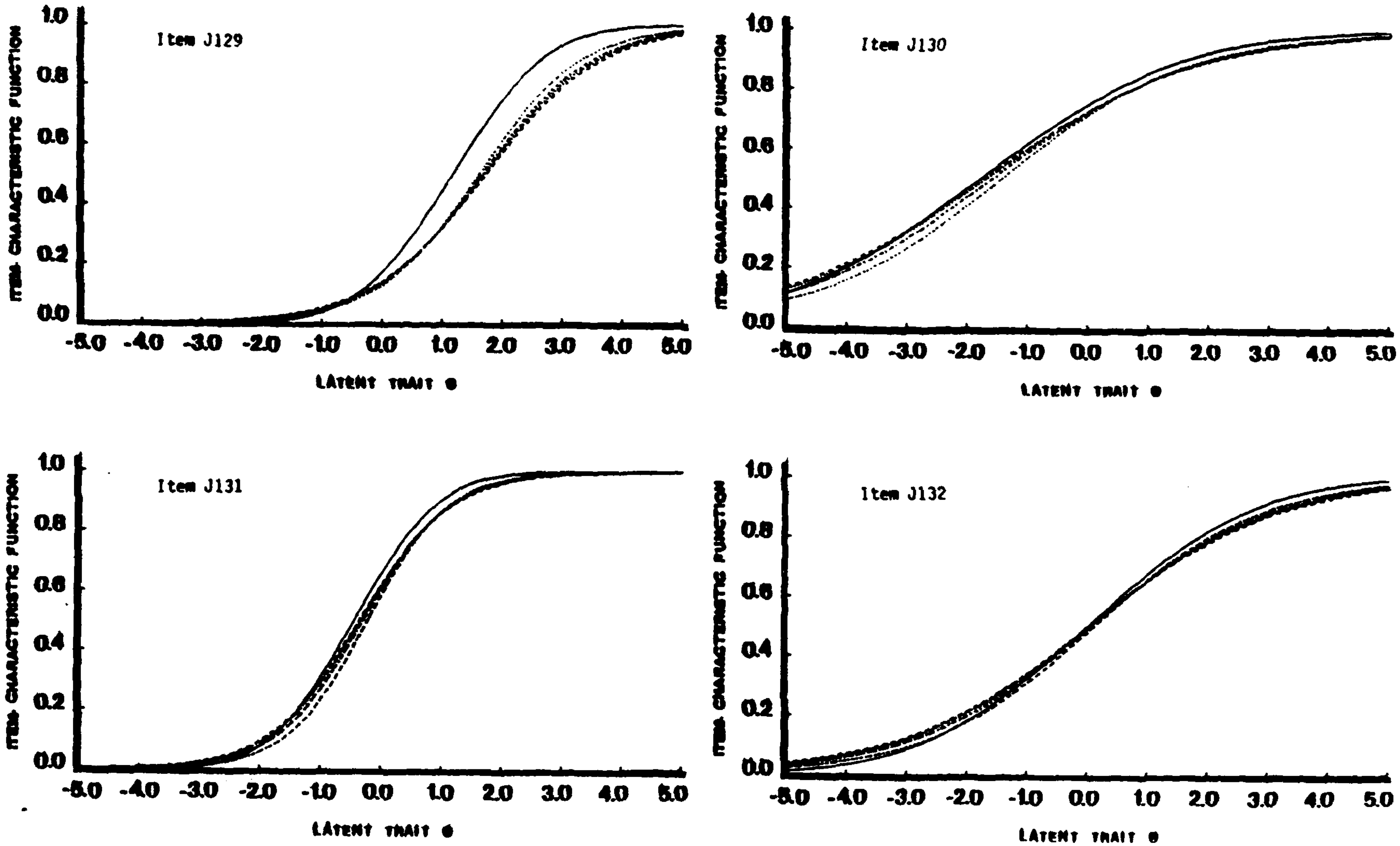

FIGURE 9-3 (Continued)

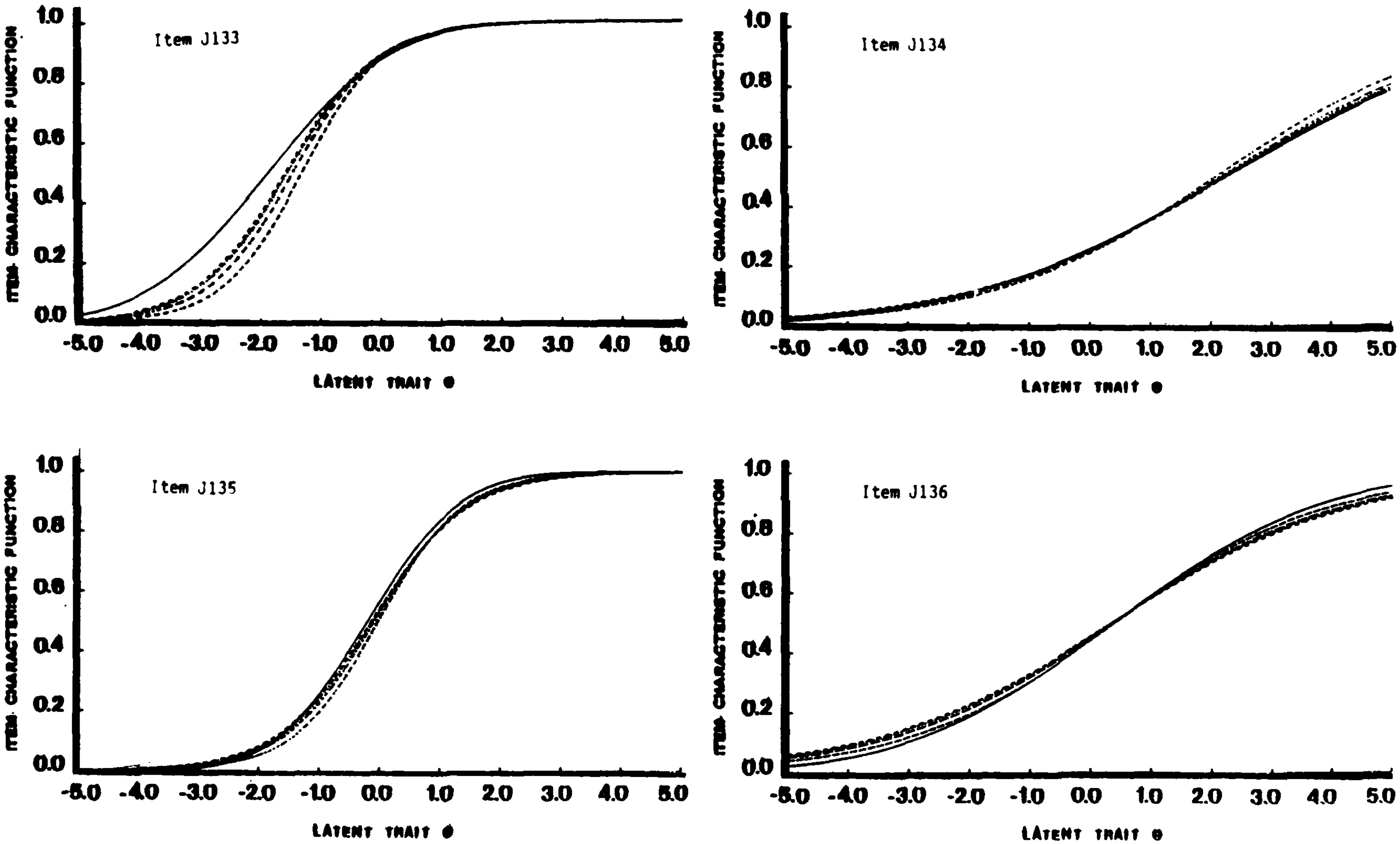

FIGURE 9-3 (Continued)

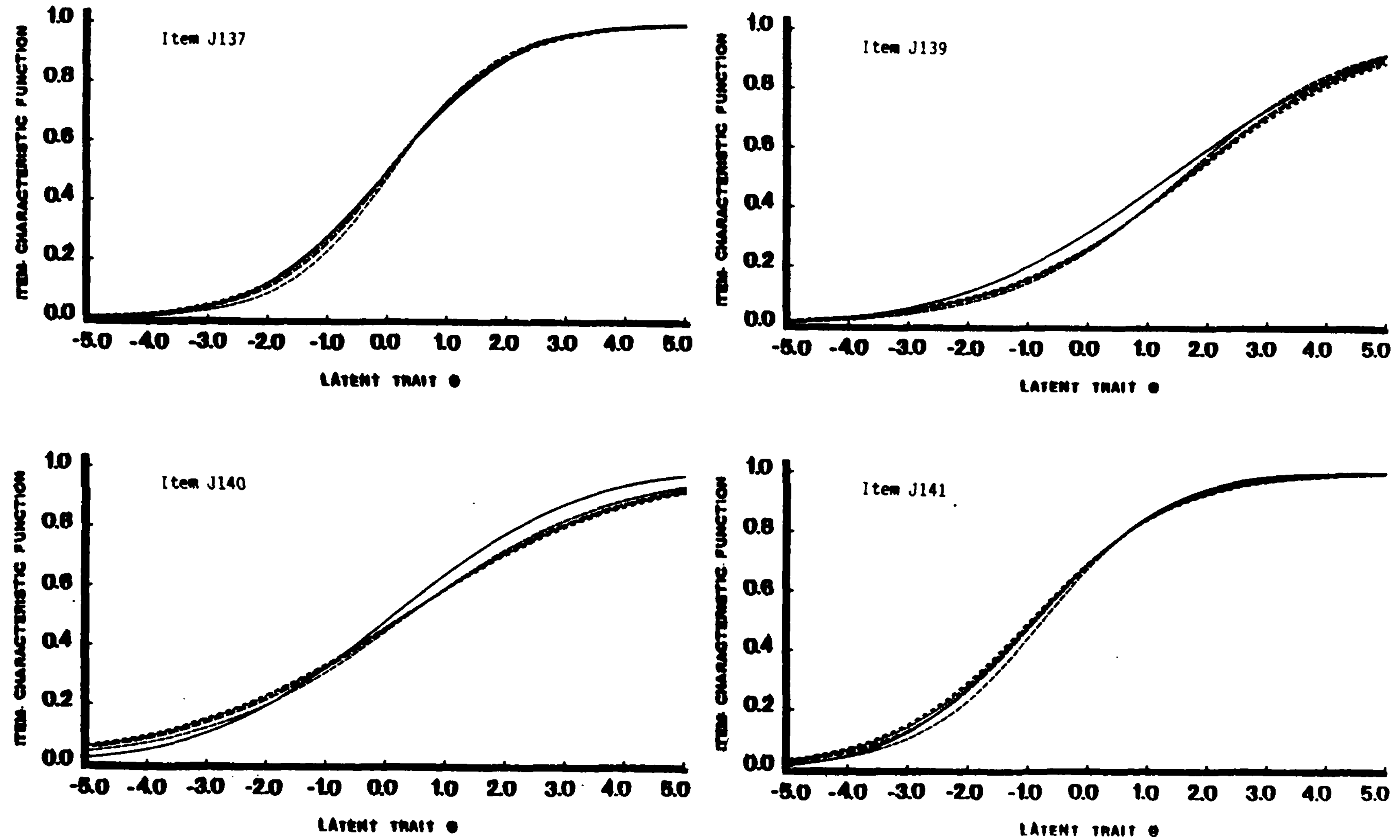

FIGURE 9-3 (Continued)

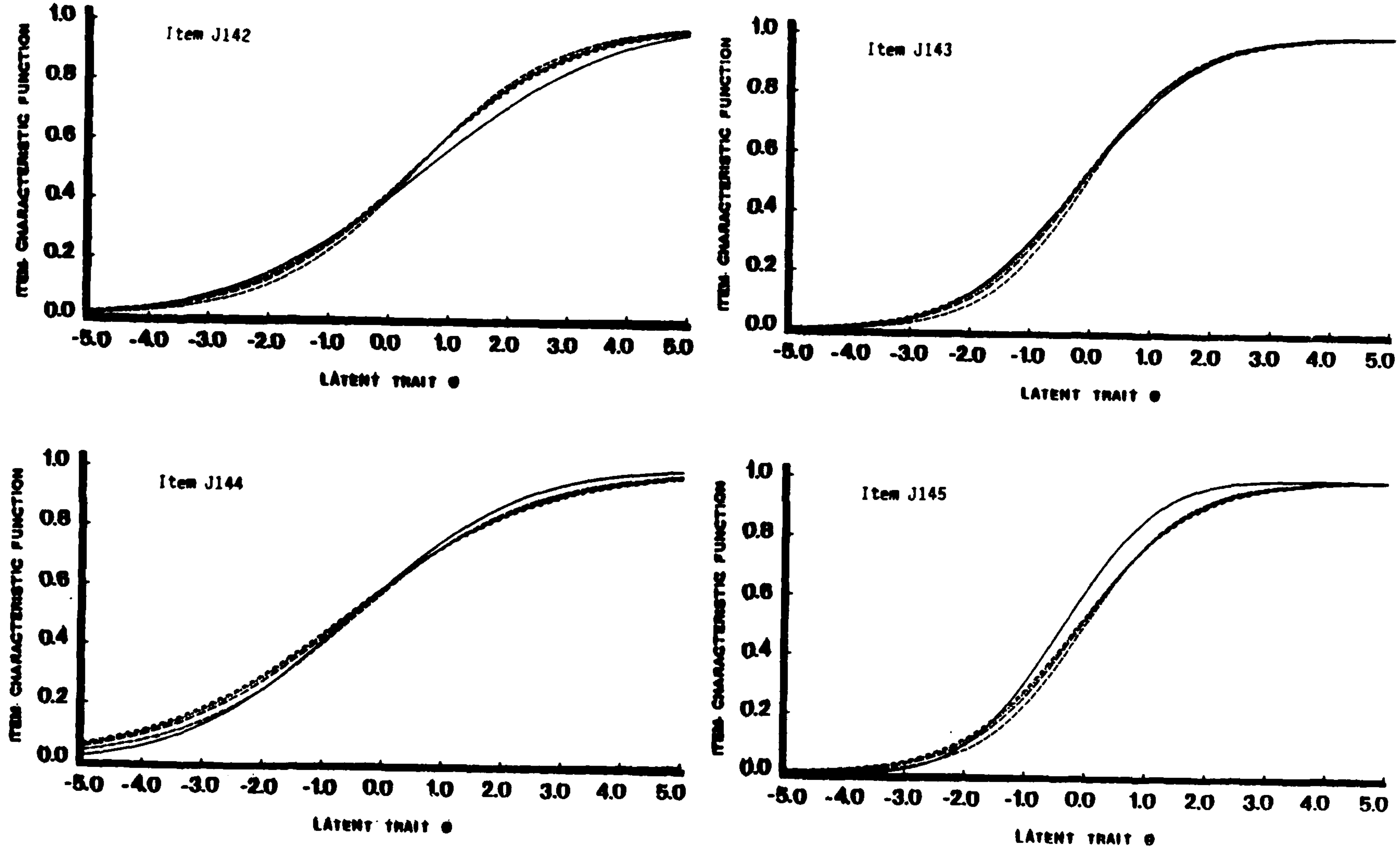

FIGURE 9-3 (Continued)

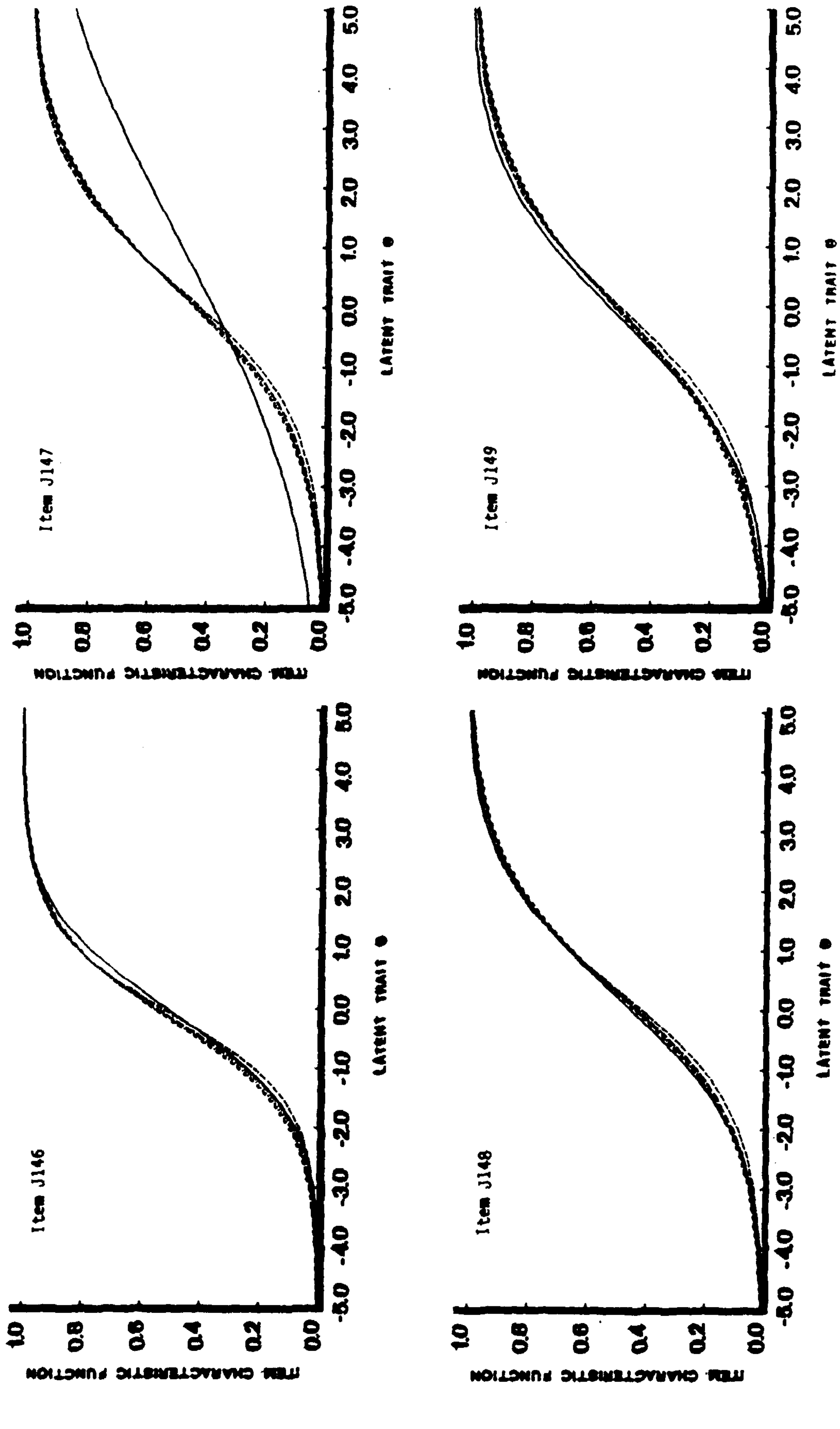

FIGURE 9-3 (Continued)

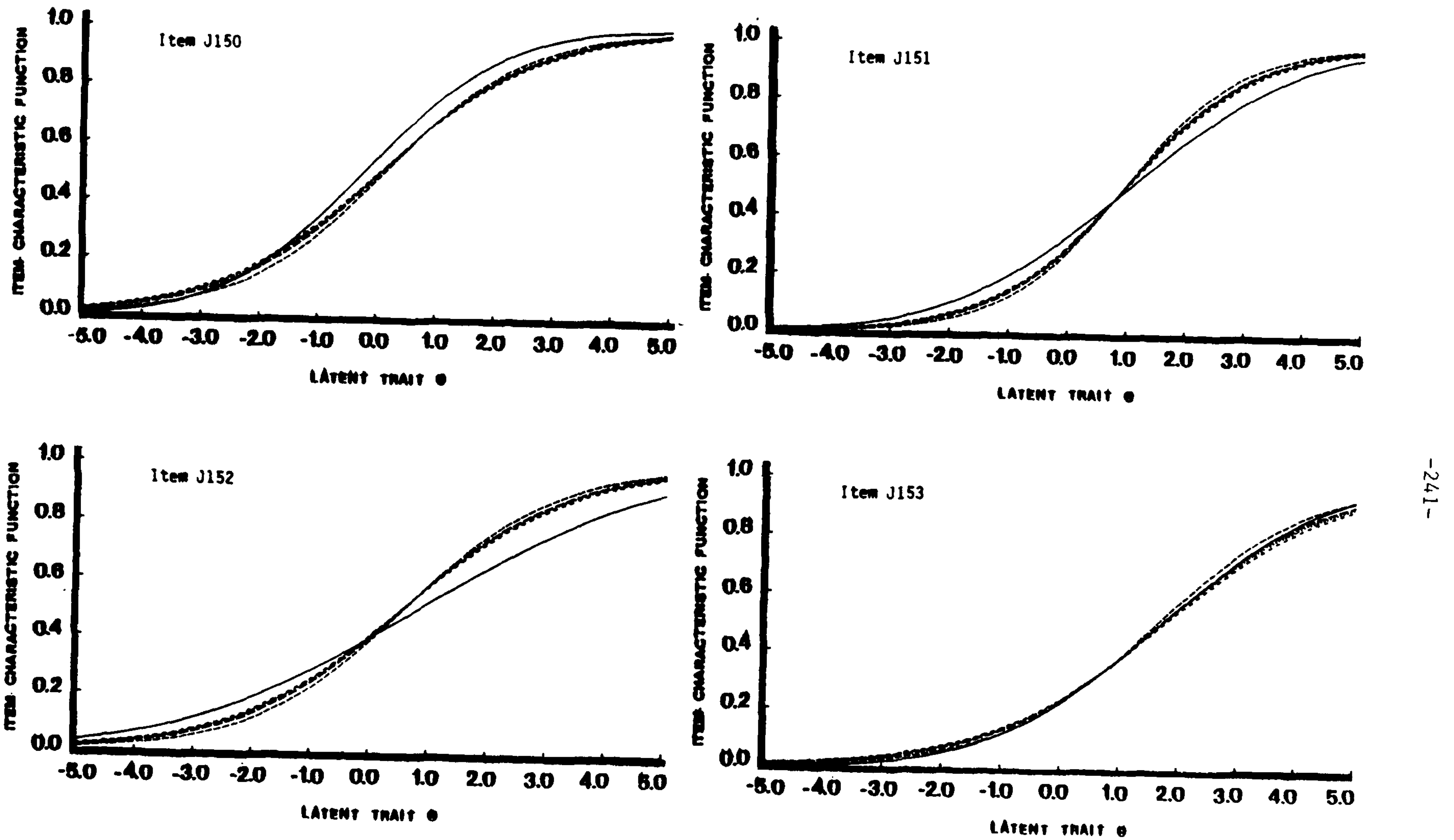

FIGURE 9-3 (Continued)

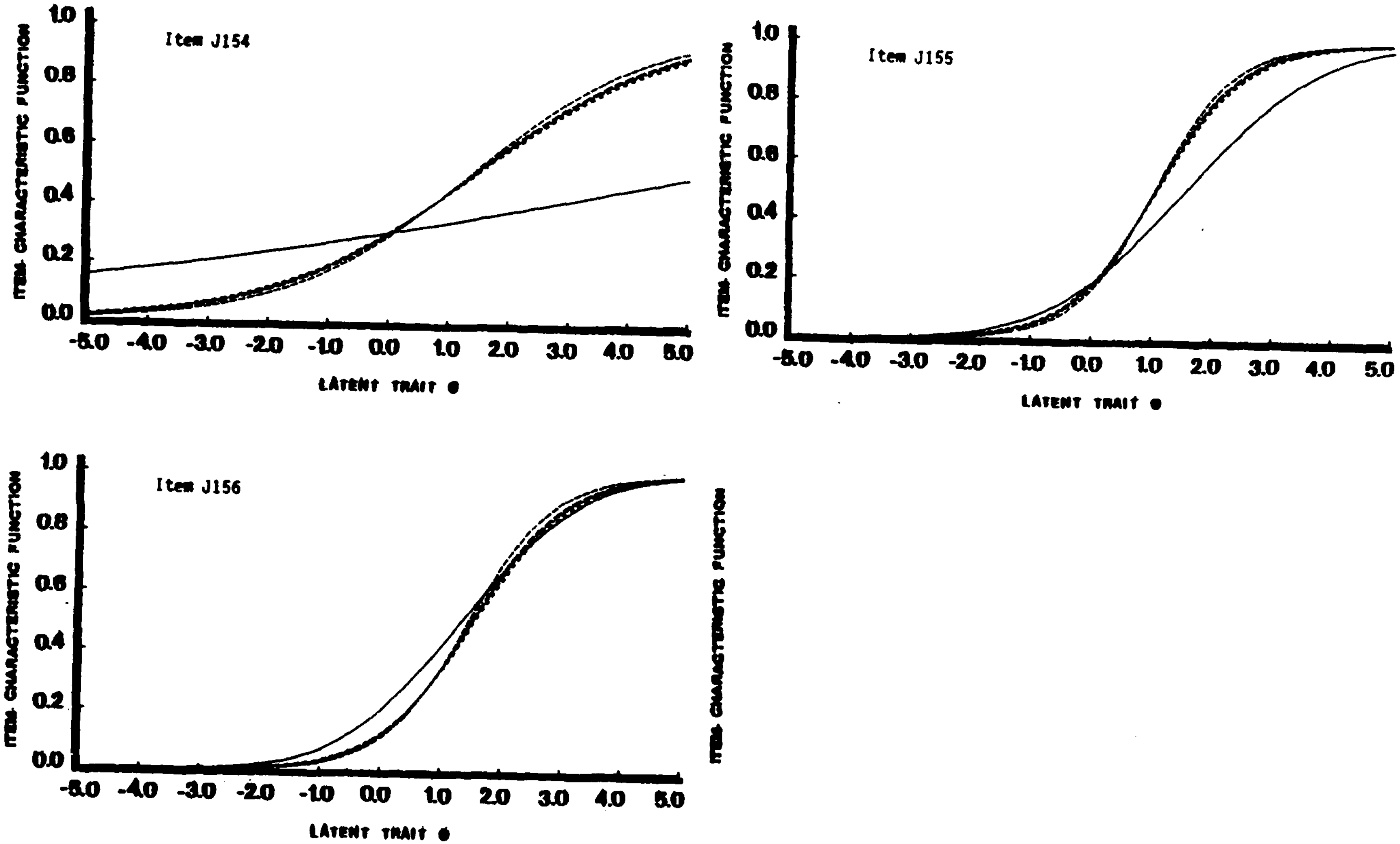

FIGURE 9-3 (Continued)

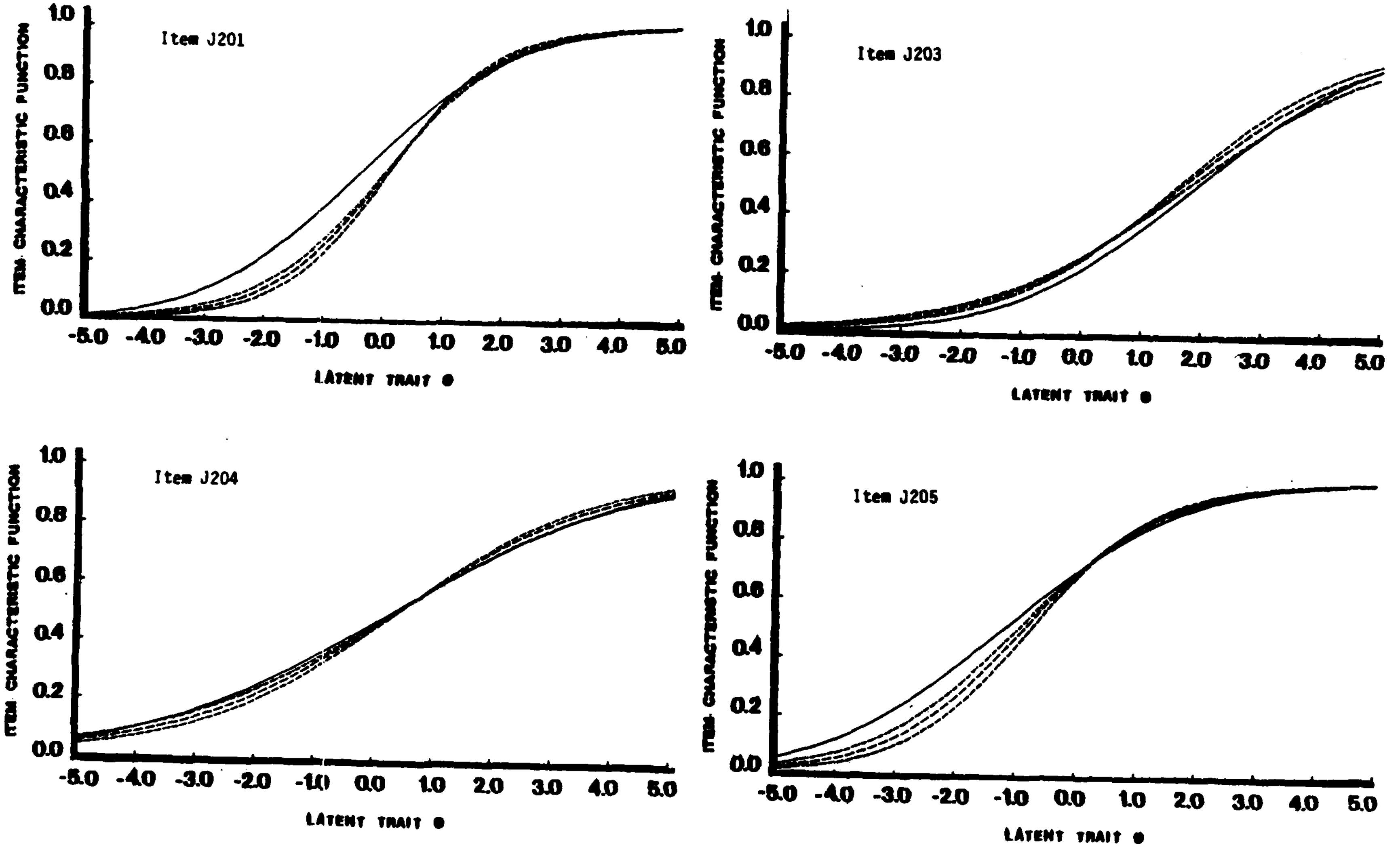

FIGURE 9-4

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Four Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Two of Which Are the Results of the J1-J2 Case Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And the Other Two of Which Are the Results of the A5-A6-J1-J2 Case Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J2.

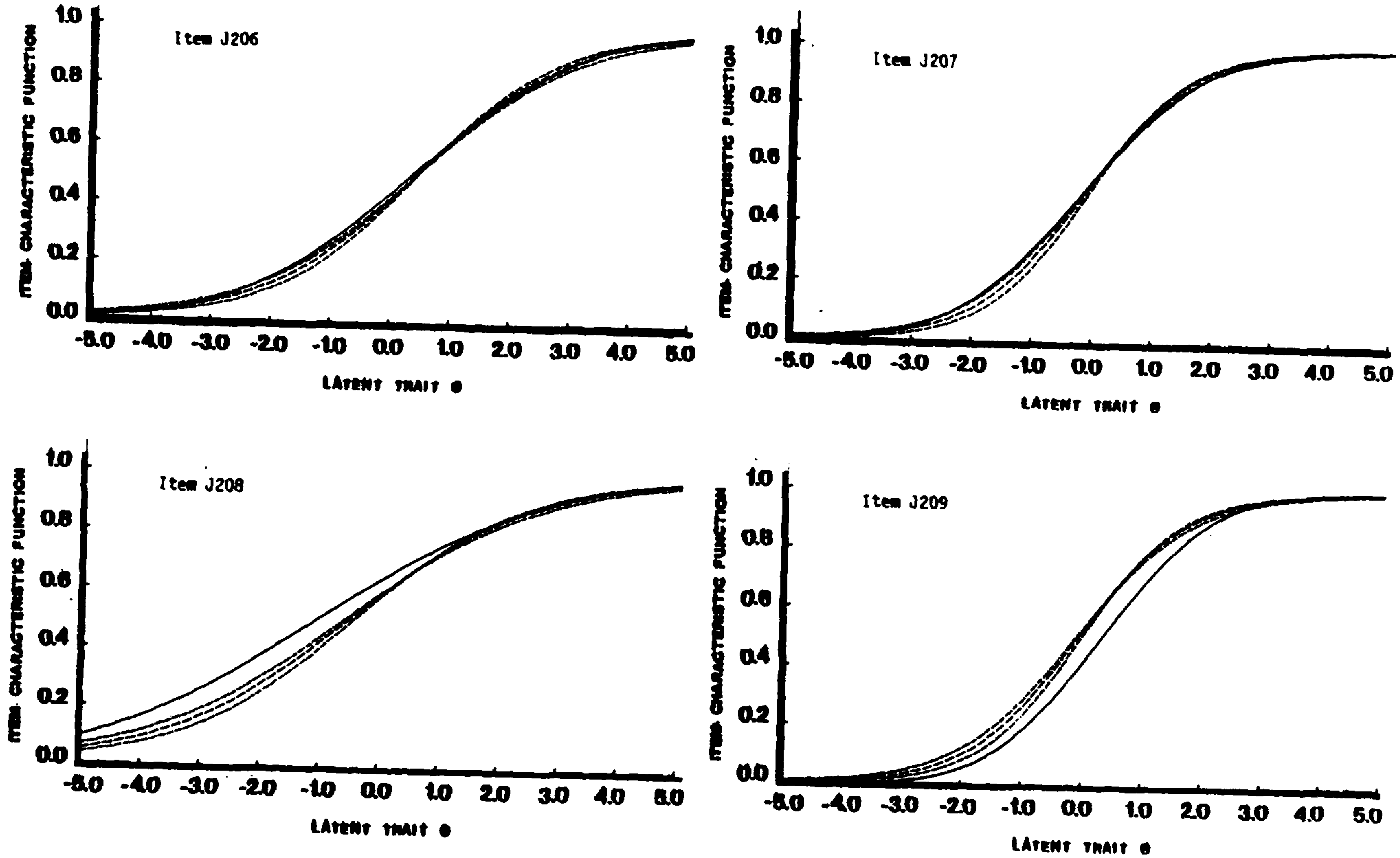

FIGURE 9-4 (Continued)

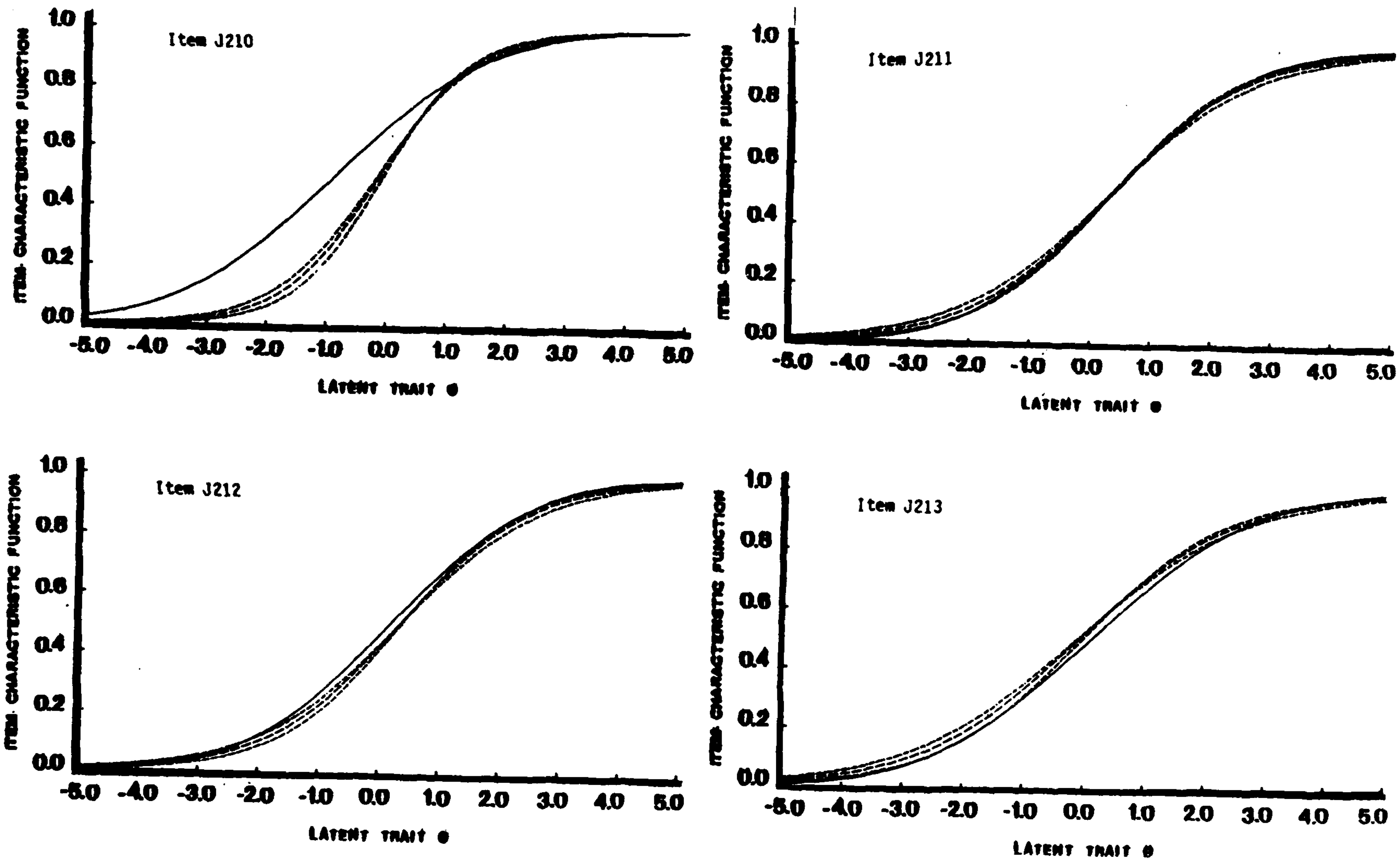

FIGURE 9-4 (Continued)

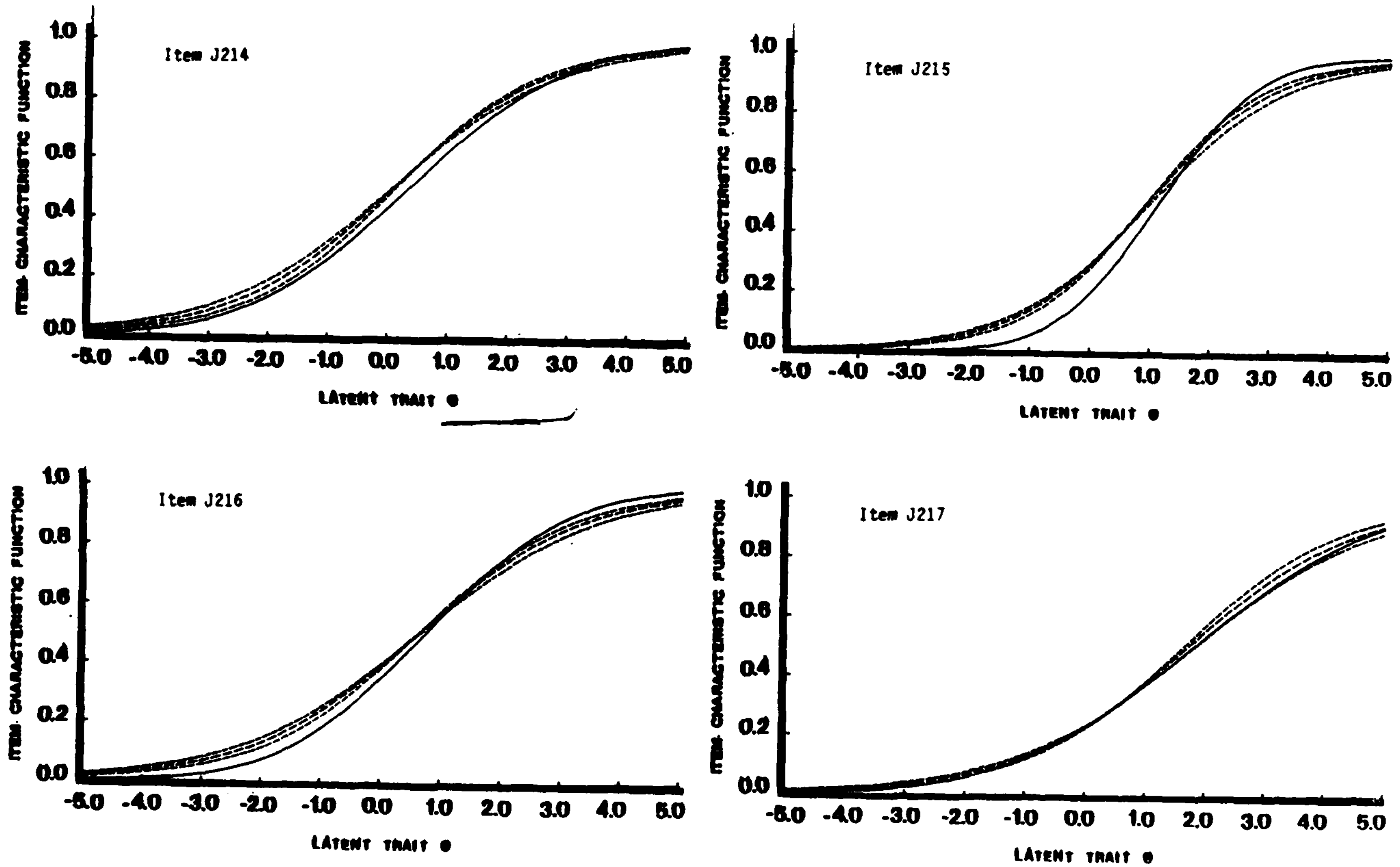

FIGURE 9-4 (Continued)

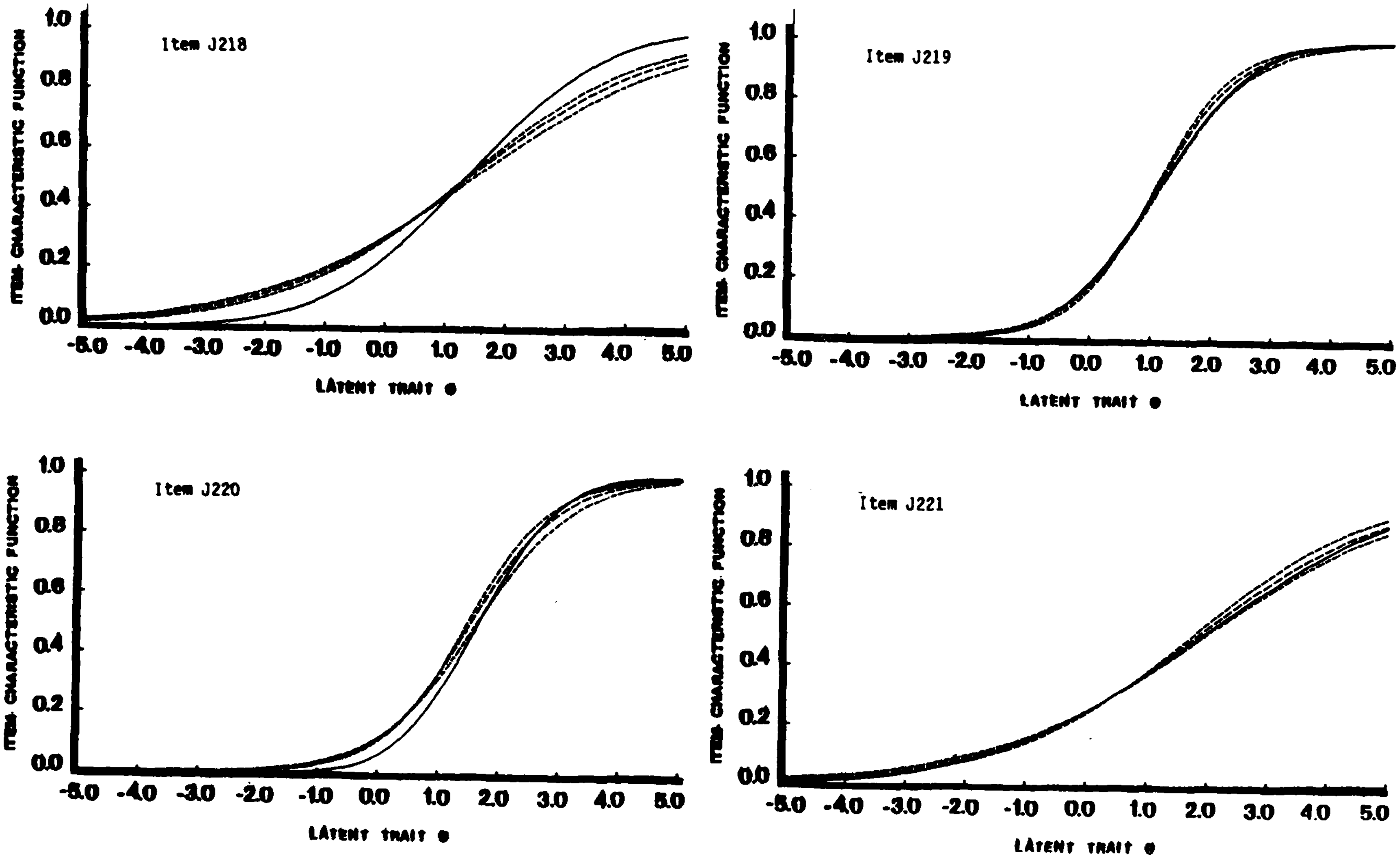

FIGURE 9-4 (Continued)

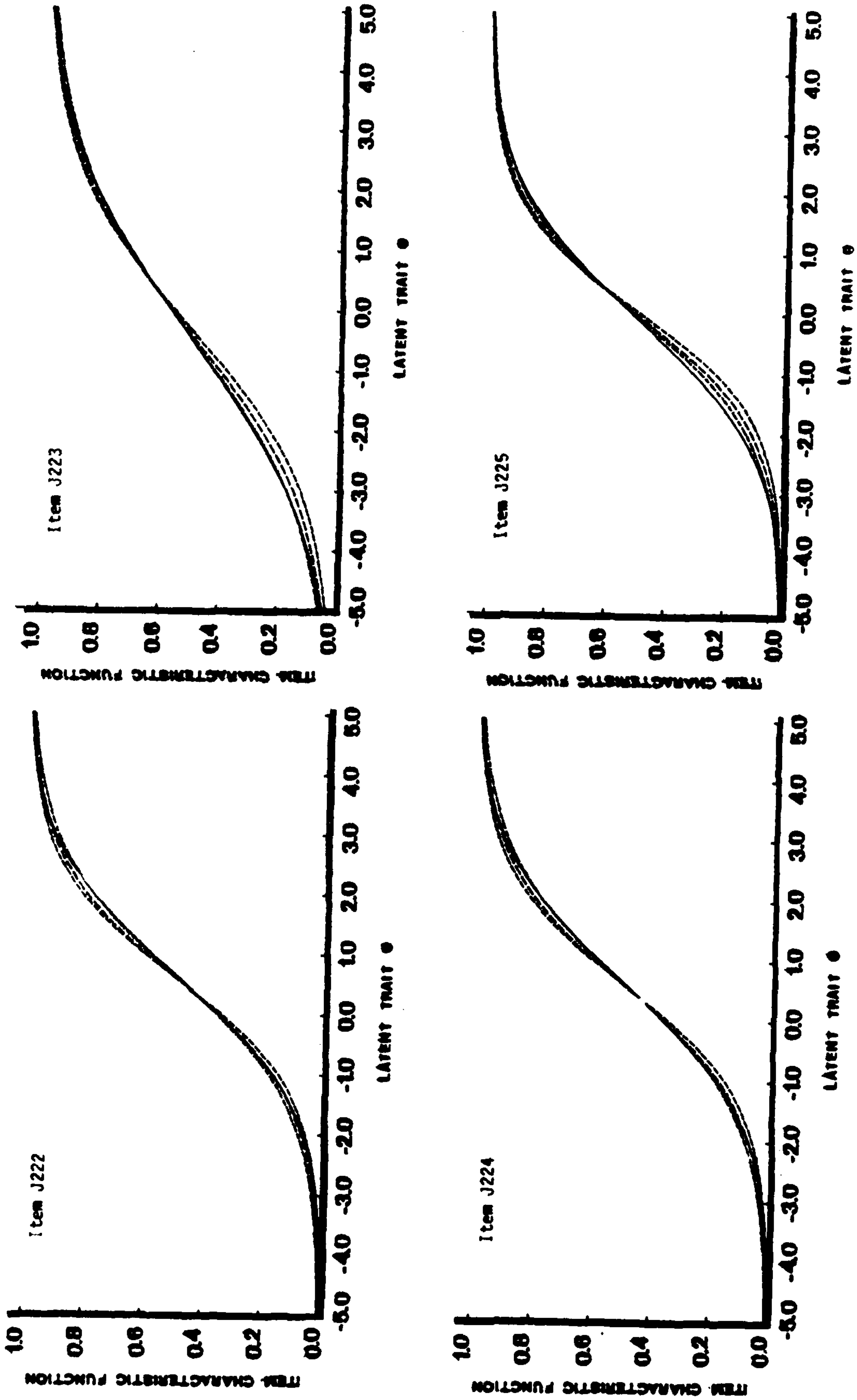

FIGURE 9-4 (Continued)

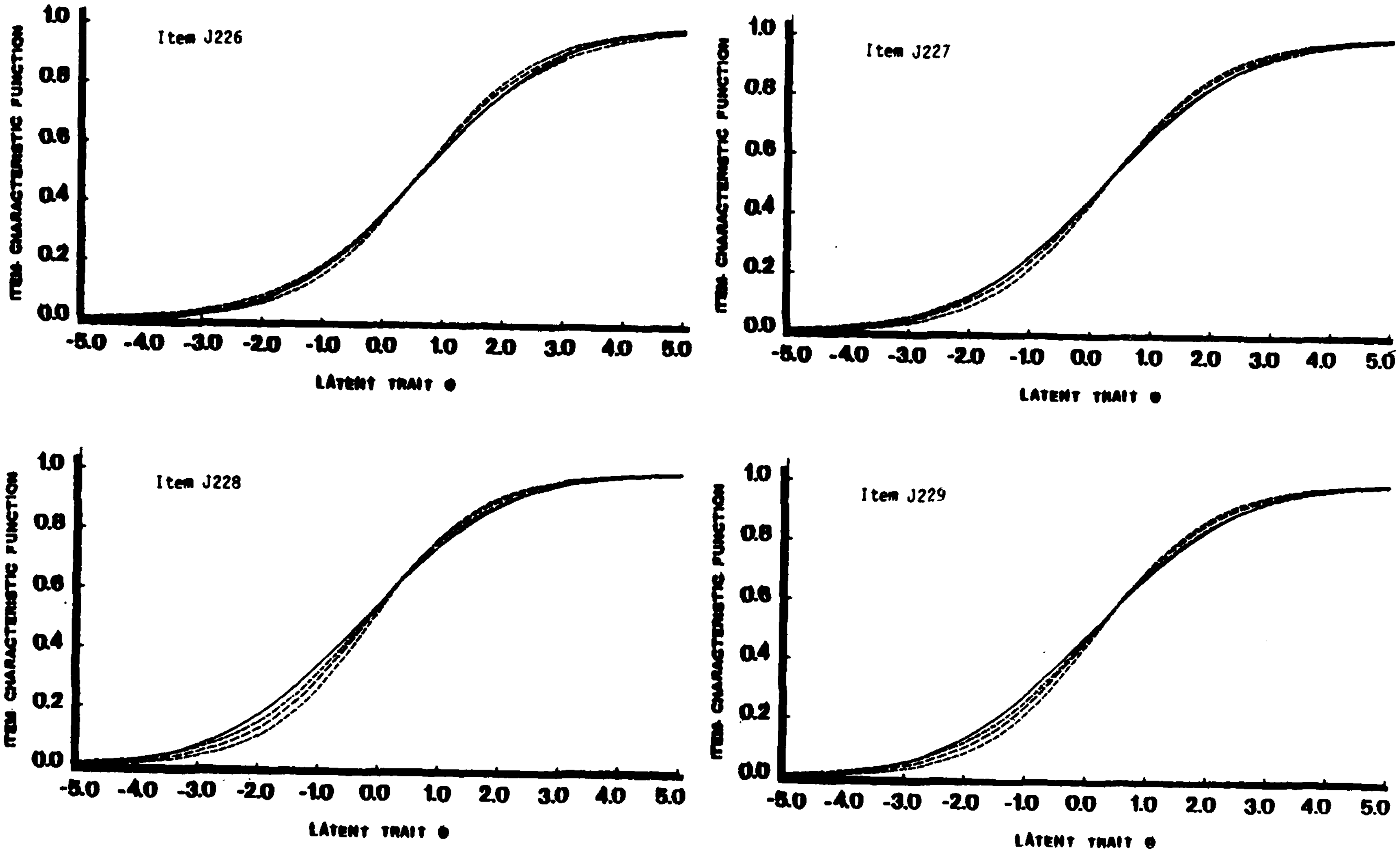

FIGURE 9-4 (Continued)

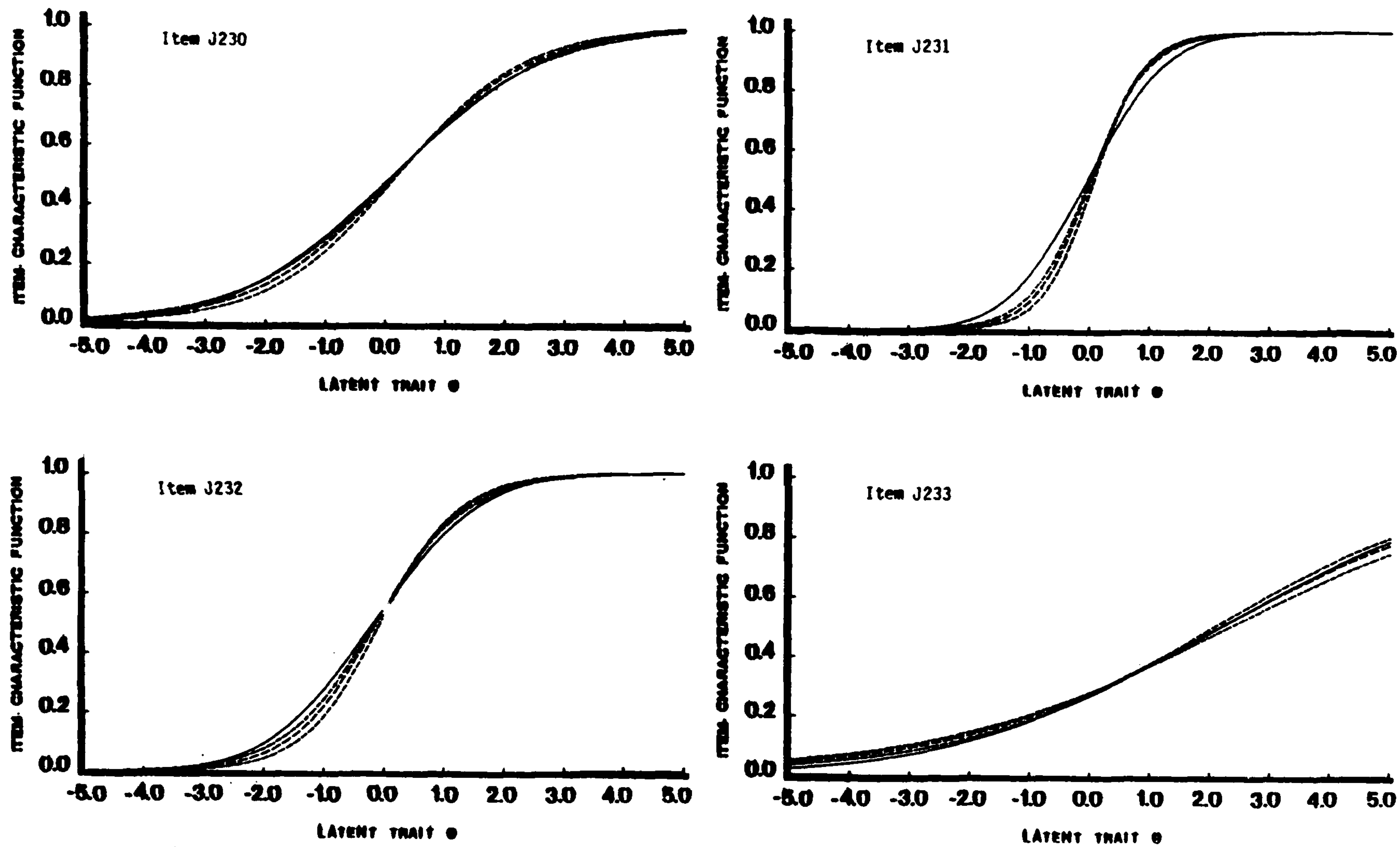

FIGURE 9-4 (Continued)

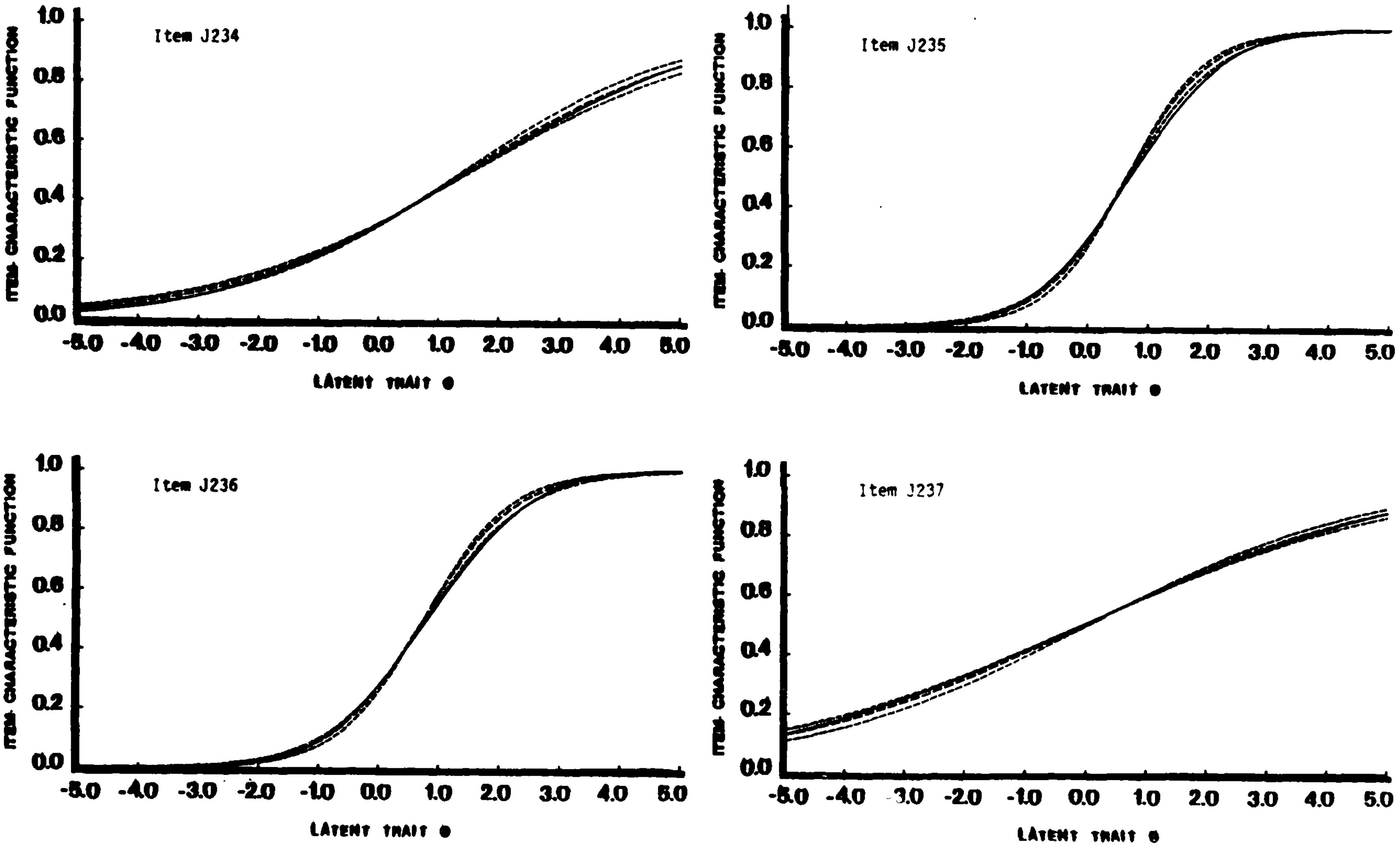

FIGURE 9-4 (Continued)

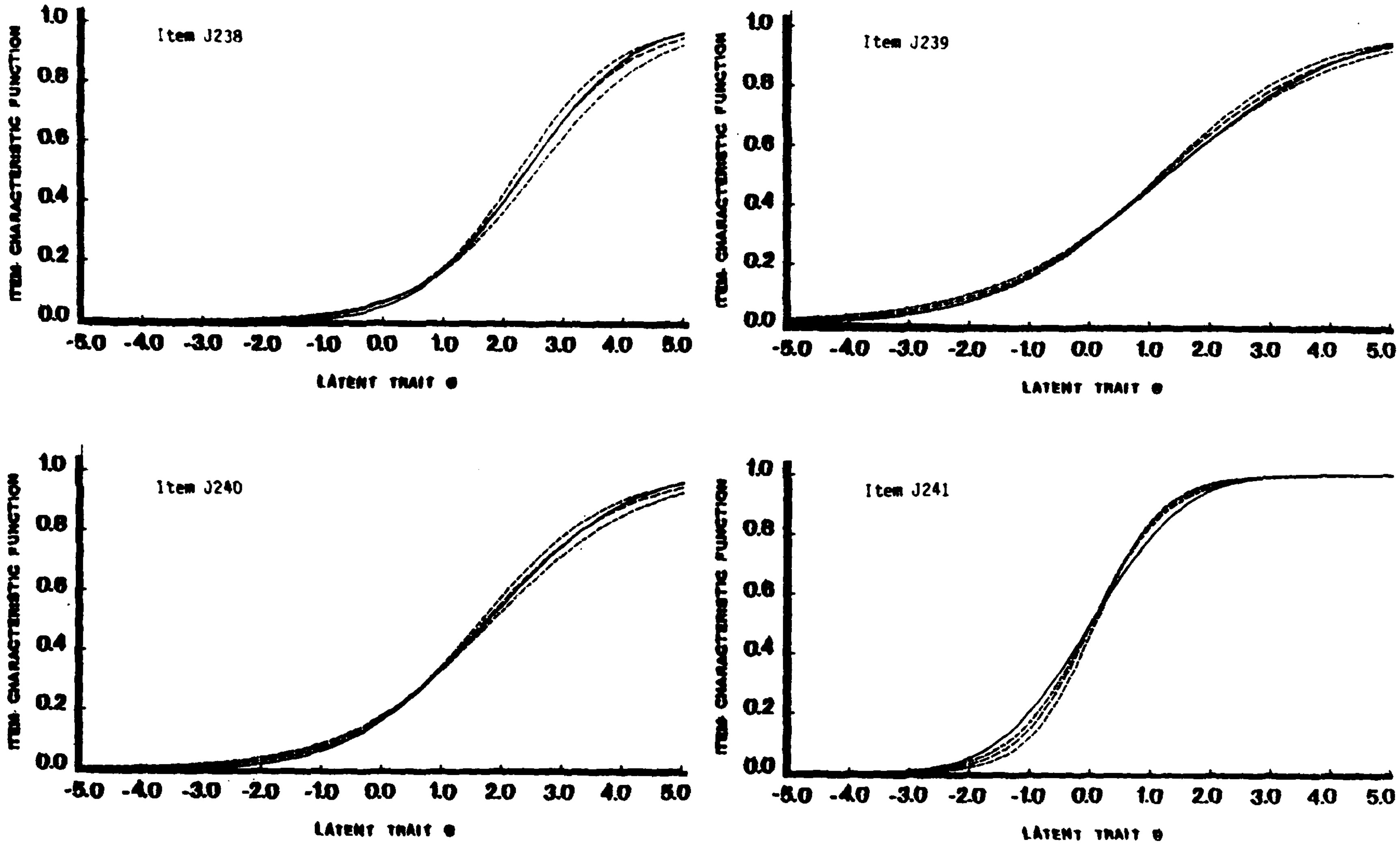

FIGURE 9-4 (Continued)

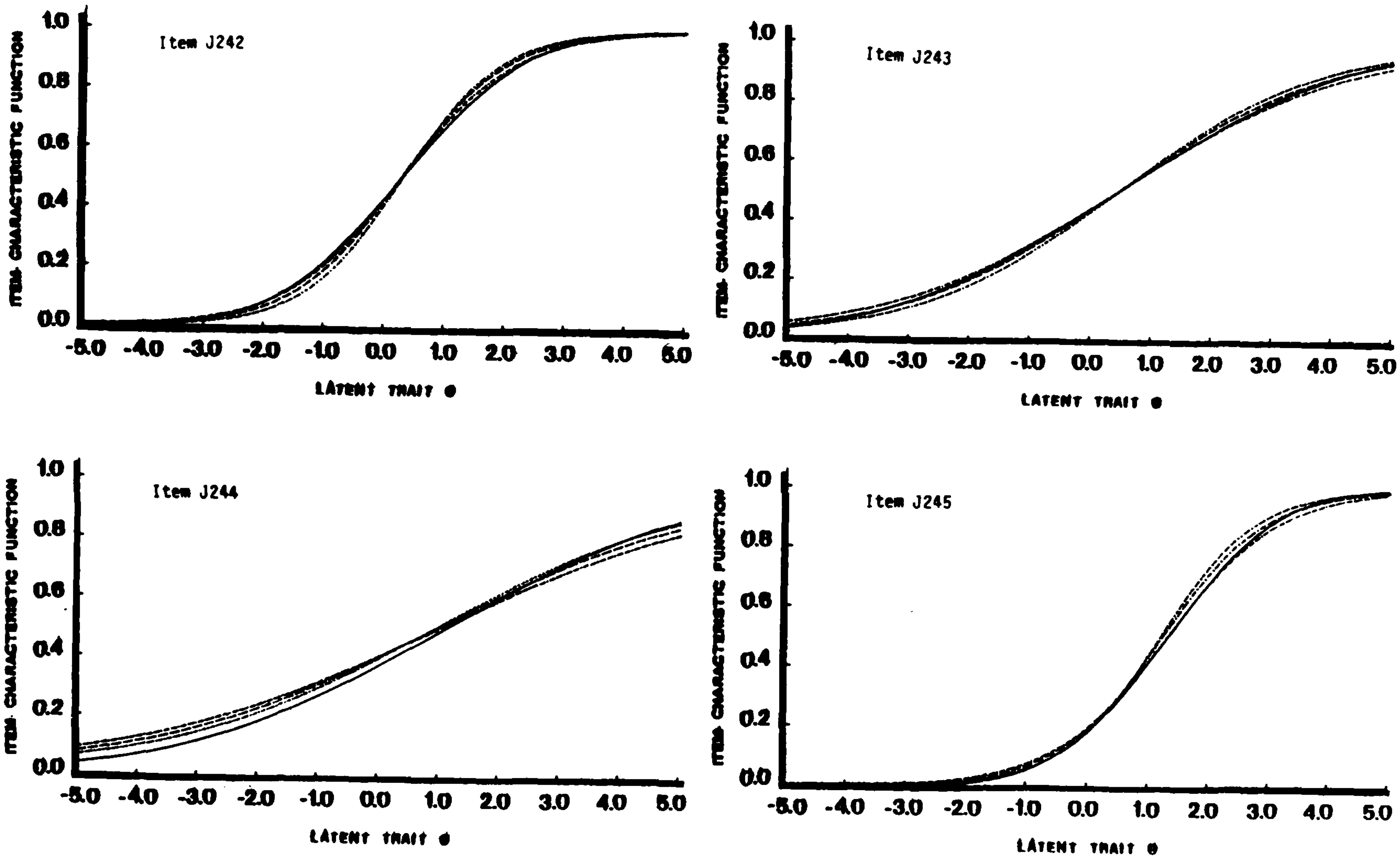

FIGURE 9-4 (Continued)

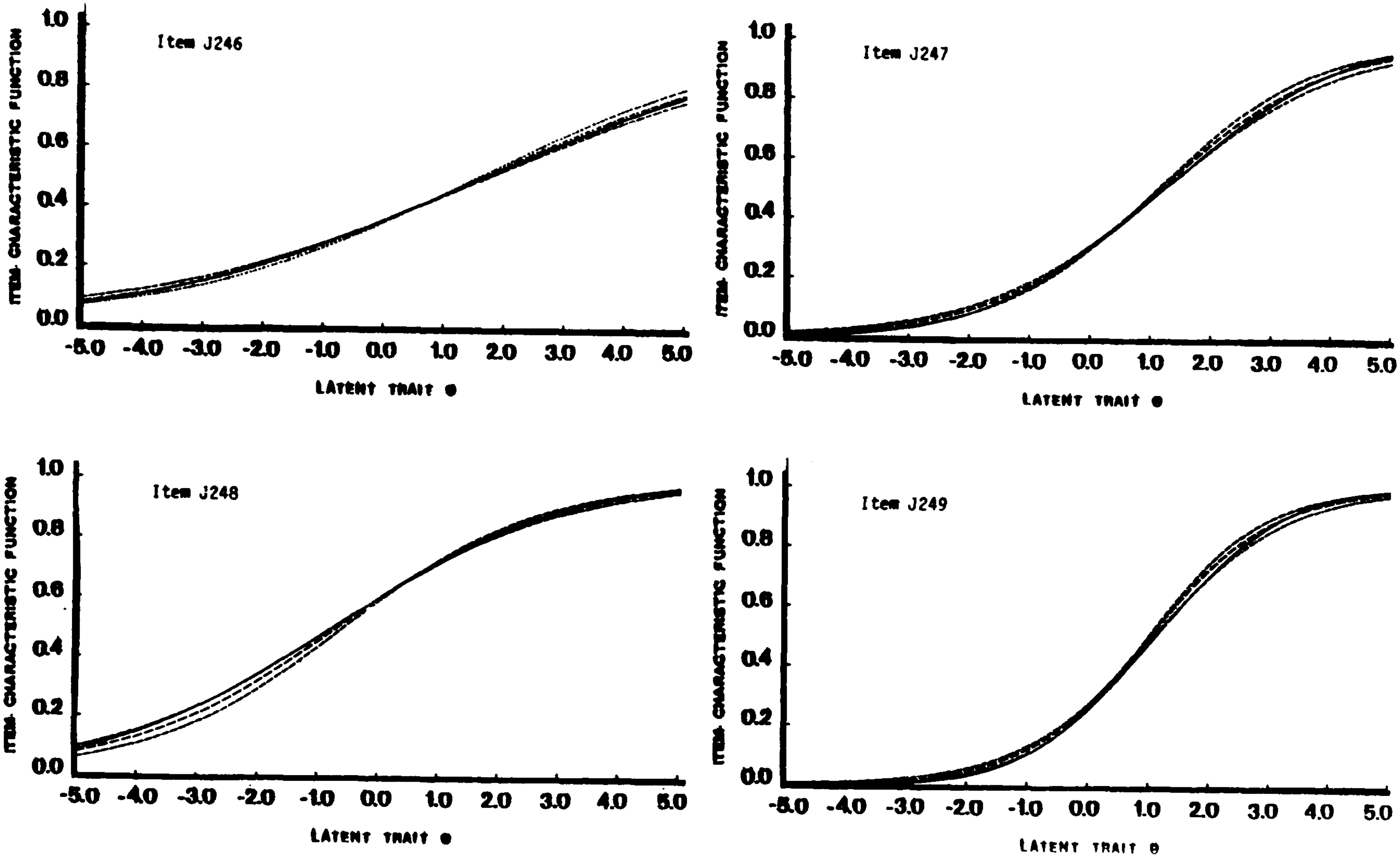

FIGURE 9-4 (Continued)

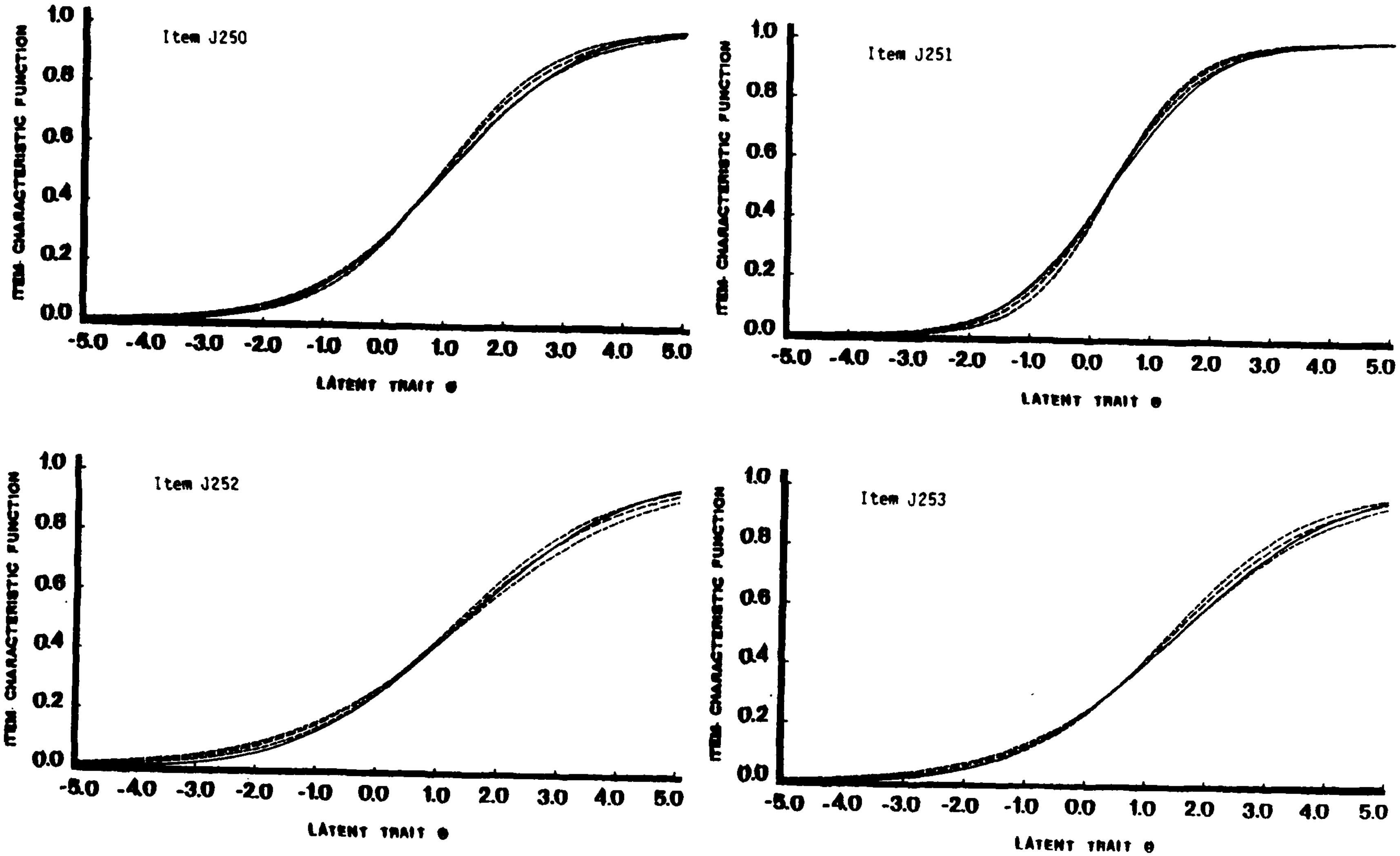

FIGURE 9-4 (Continued)

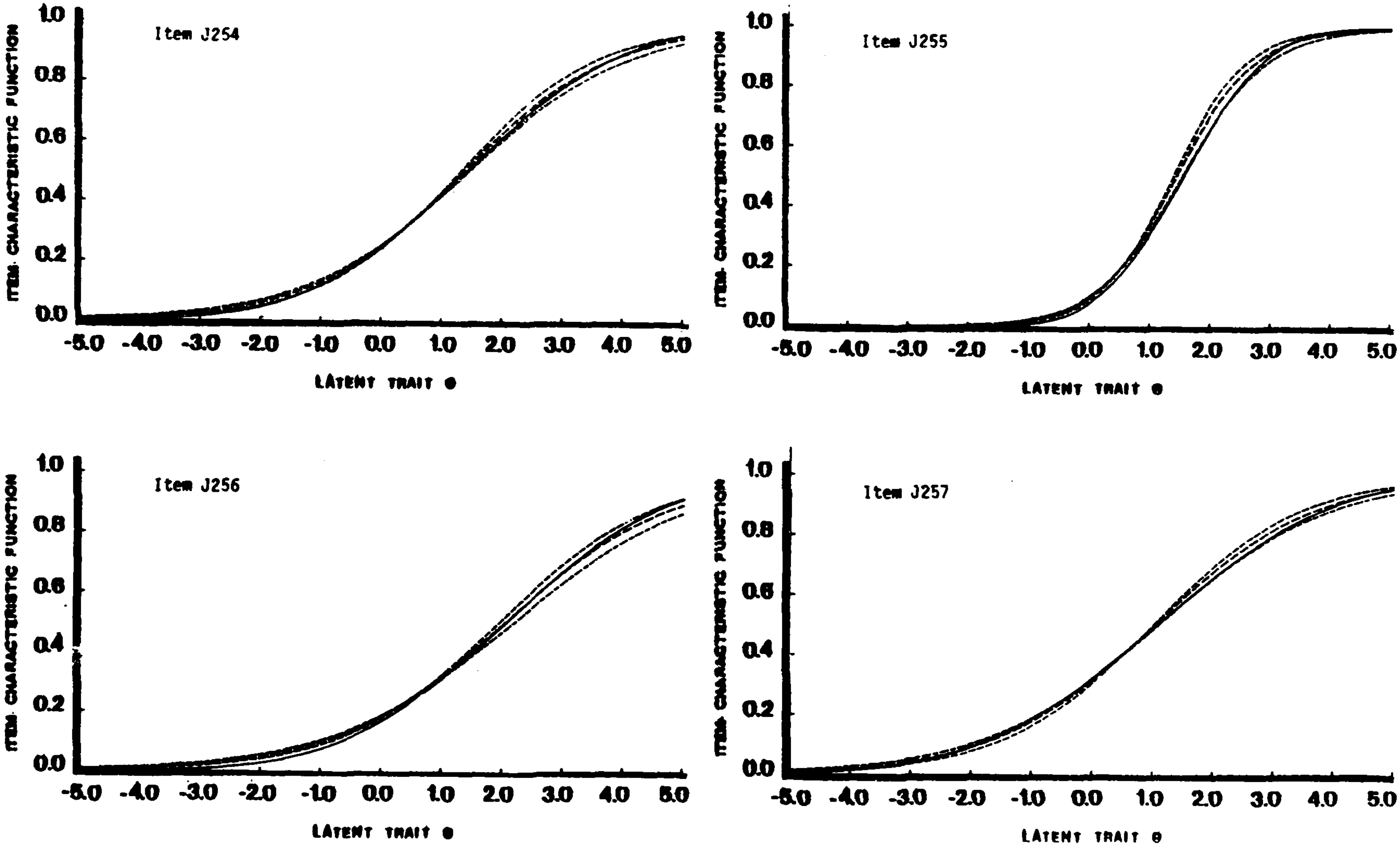

FIGURE 9-4 (Continued)

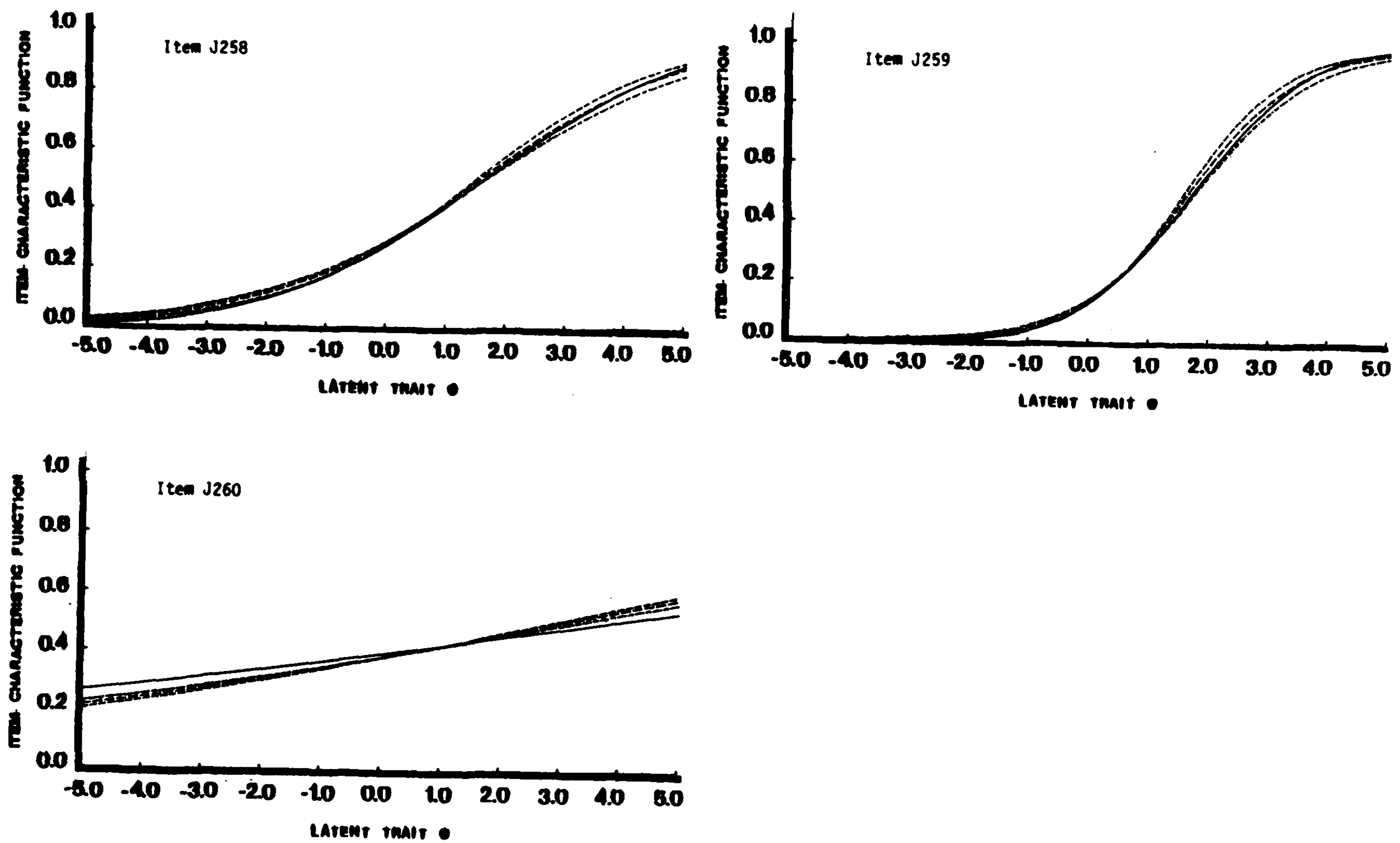

FIGURE 9-4 (Continued)

estimated item characteristic function is in the normal ogive model, and the other four are in the (two-parameter) logistic model. We notice that there are basically two sets of estimated item parameters which were obtained by Logist 5, i.e., one based upon either Case A5-A6 or Case J1-J2 and the other upon Case A5-A6-J1-J2. For brevity, hereafter, we shall call the former approach Method A and the latter Method B. In each of these two cases the estimated item parameters were adjusted twice, i.e., first on the assumption that the mean and the standard deviation of the distribution of $\hat{\theta}$ are the same as those of the distribution of θ, and, secondly, without this assumption. These adjusted estimated item parameters in the first situation are given in Tables 7-13 through 7-20, and those in the second situation are shown in Tables 8-3 through 8-10, respectively, for the items of Tests A5, A6, J1 and J2. In each graph of Figures 9-1 through 9-4, the results based upon Method A and upon the first and the second scale adjustments are drawn by a long dashed line and a short dashed line, respectively, and those based upon Method B and upon the first and the second adjustments are shown by a dashed line of medium length and dotted line, respectively.

From these results, we can say the following.

(1) For many items, the two Logist 5 results based upon the second scale adjustment are close to each other, while those based upon the first scale adjustment are substantially different from each other.

(2) In addition to the above, the two Logist 5 results based upon

the second scale adjustment also tend to be closer to the result of Tetrachoric Method.

These two findings seem to justify the second scale adjustment, and also to support the consistency in the results of the two methods, i.e., Tetrachoric Method and Logist 5 .

Figures 9-5 and 9-6 present the results of J1/1075 and J1/2259 Cases for each item of Test J1. Again in each of these graphs a solid curve represents the estimated item characteristic function in the normal ogive model, whose item parameters were originally obtained by Tetrachoric Method and then adjusted, and presented in Tables 6-8 and 6-9. The other four curves are based upon the estimated item parameters obtained by Logist 5 , with two of them by assuming (two-parameter) logistic model and the other two by assuming three-parameter logistic model. The results in the (two-parameter) logistic model with the first and the second scale adjustments, whose estimated item parameters are shown in Tables 7-21 or 7-23 and in Table 8-11 or 8-13, are drawn by a long dashed line and a short dashed line, respectively; the results obtained by assuming three-parameter logistic model with the first and second scale adjustments, whose estimated item parameters are presented in Table 7-22 or 7-24, and in Table 8-12 or 8-14, are shown by a dashed line of medium length and a dotted line, respectively.

From these results we can find the following.

(3) For many items the logistic curve obtained with the second scale adjustment, which is shown by a short dashed line, is very

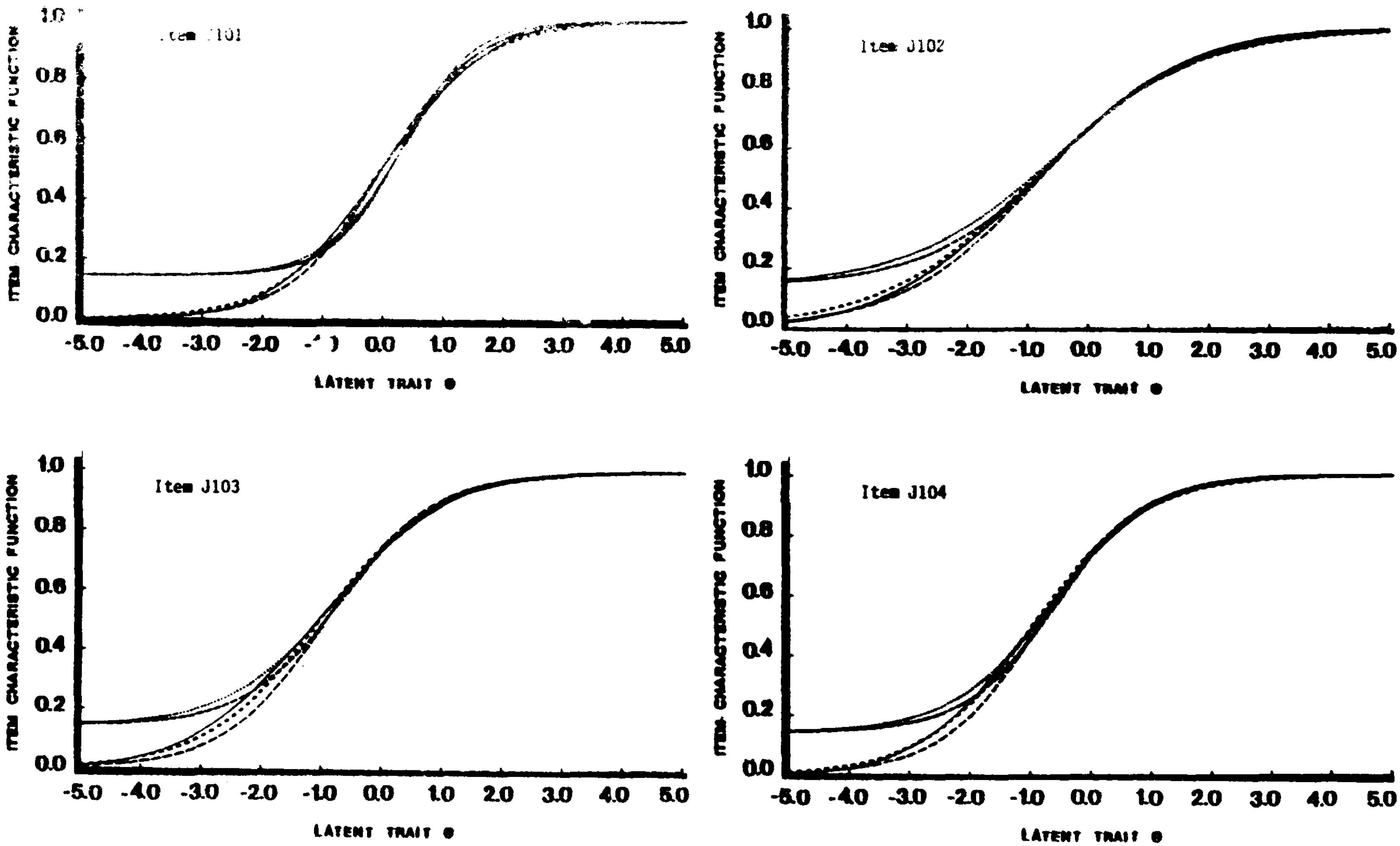

FIGURE 9-5

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Two Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And Two Estimated Item Characteristic Functions Following the Three-Parameter Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1. Results of the J1/1075 Case.

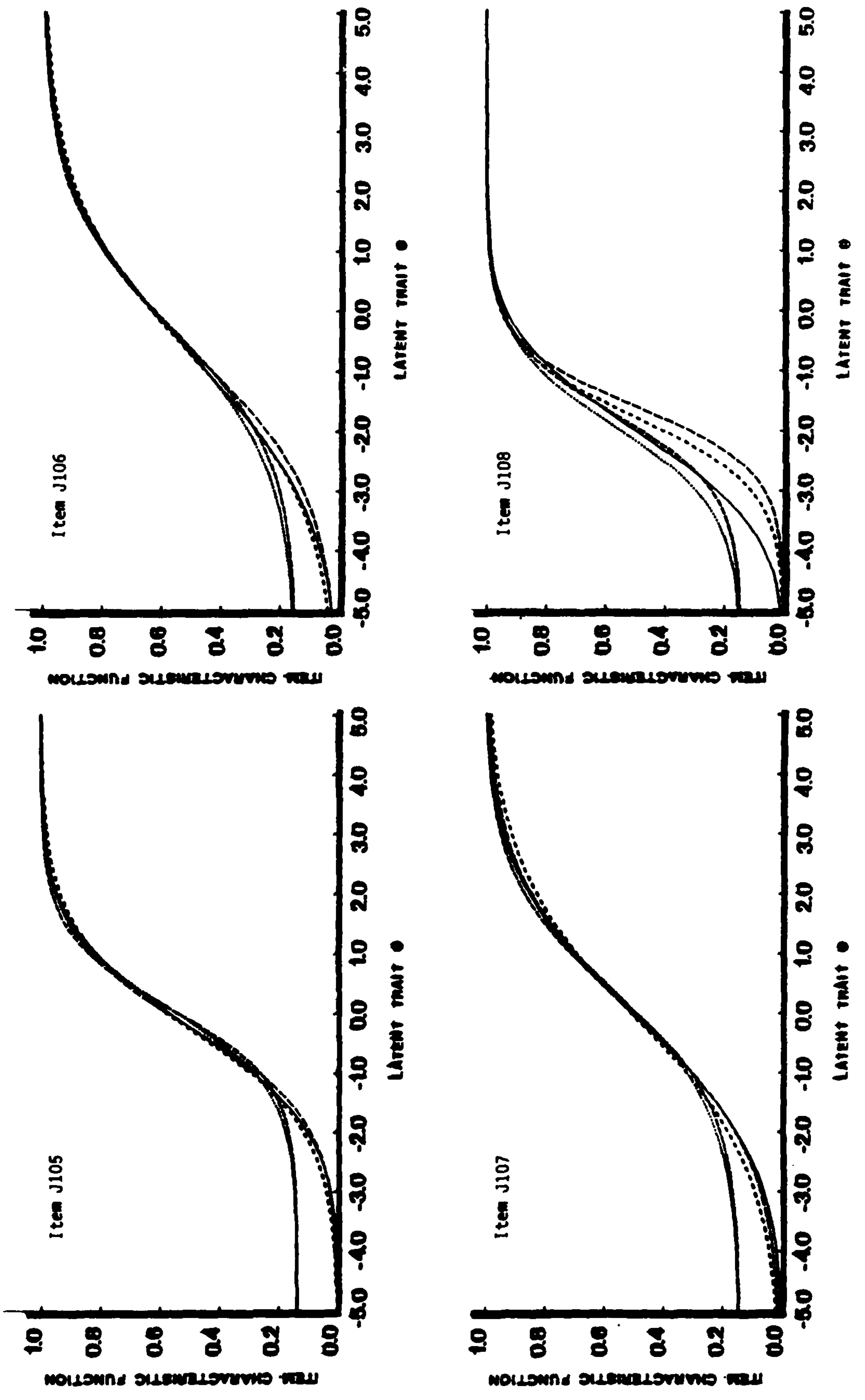

FIGURE 9-5 (Continued)

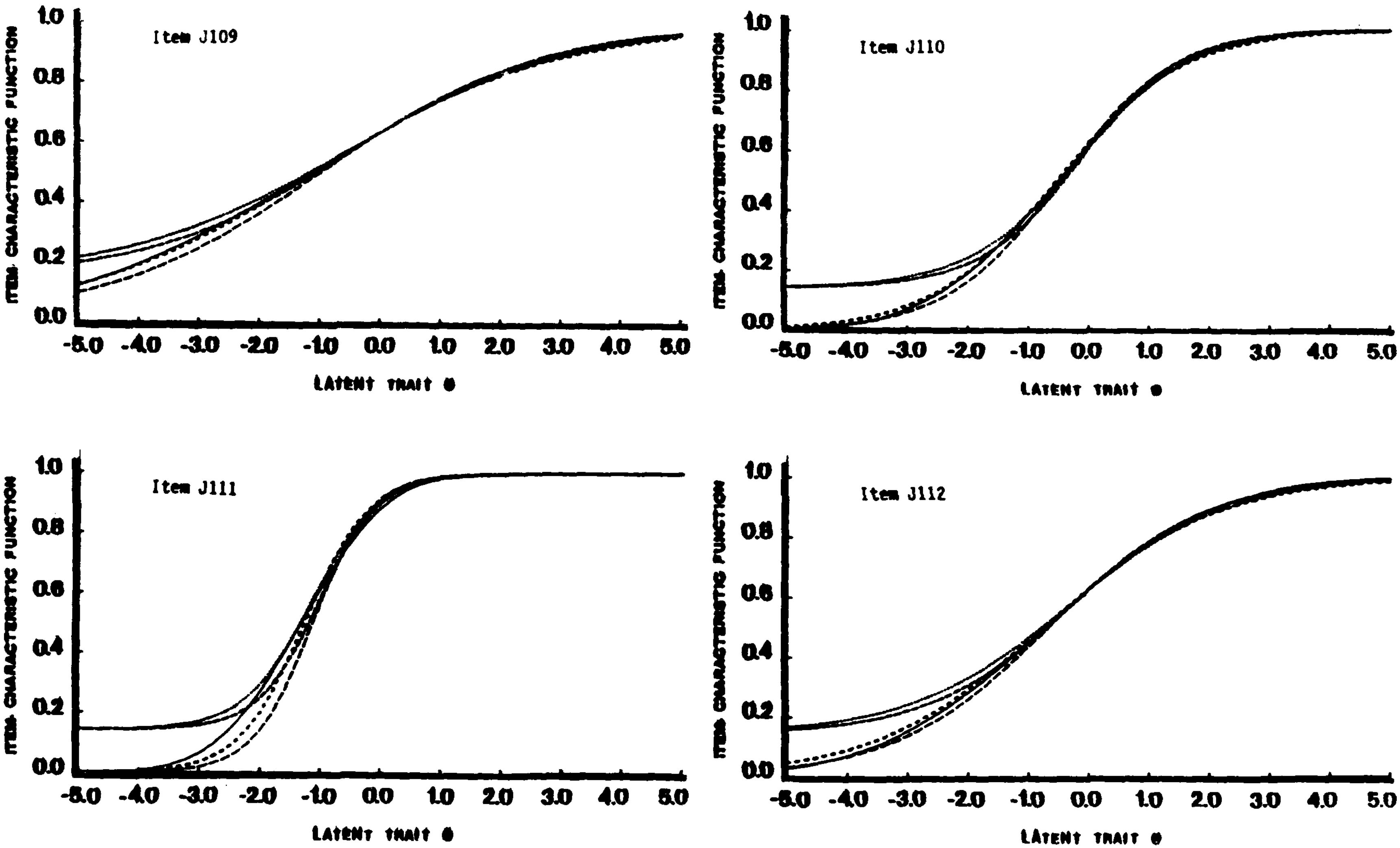

FIGURE 9-5 (Continued)

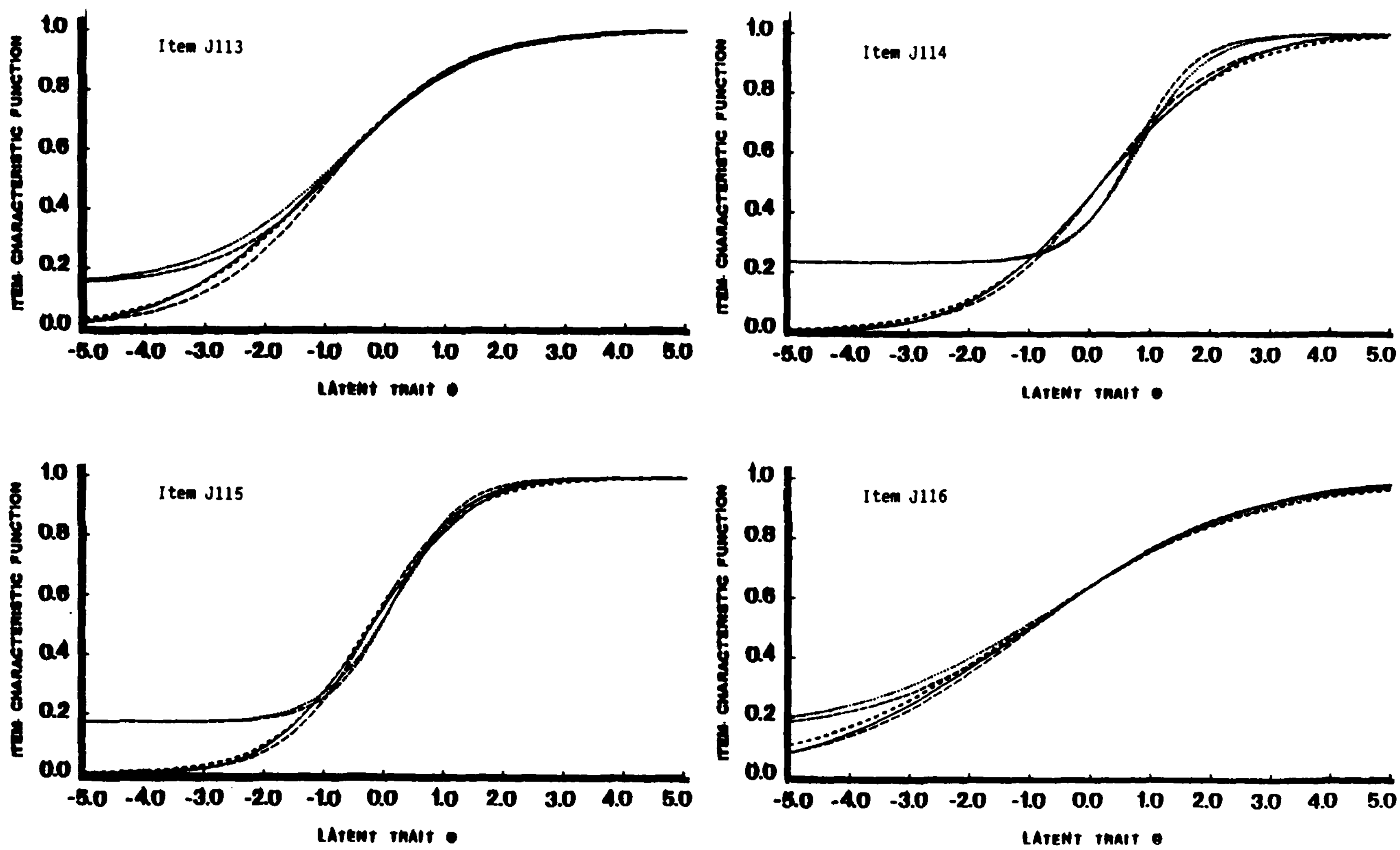

FIGURE 9-5 (Continued)

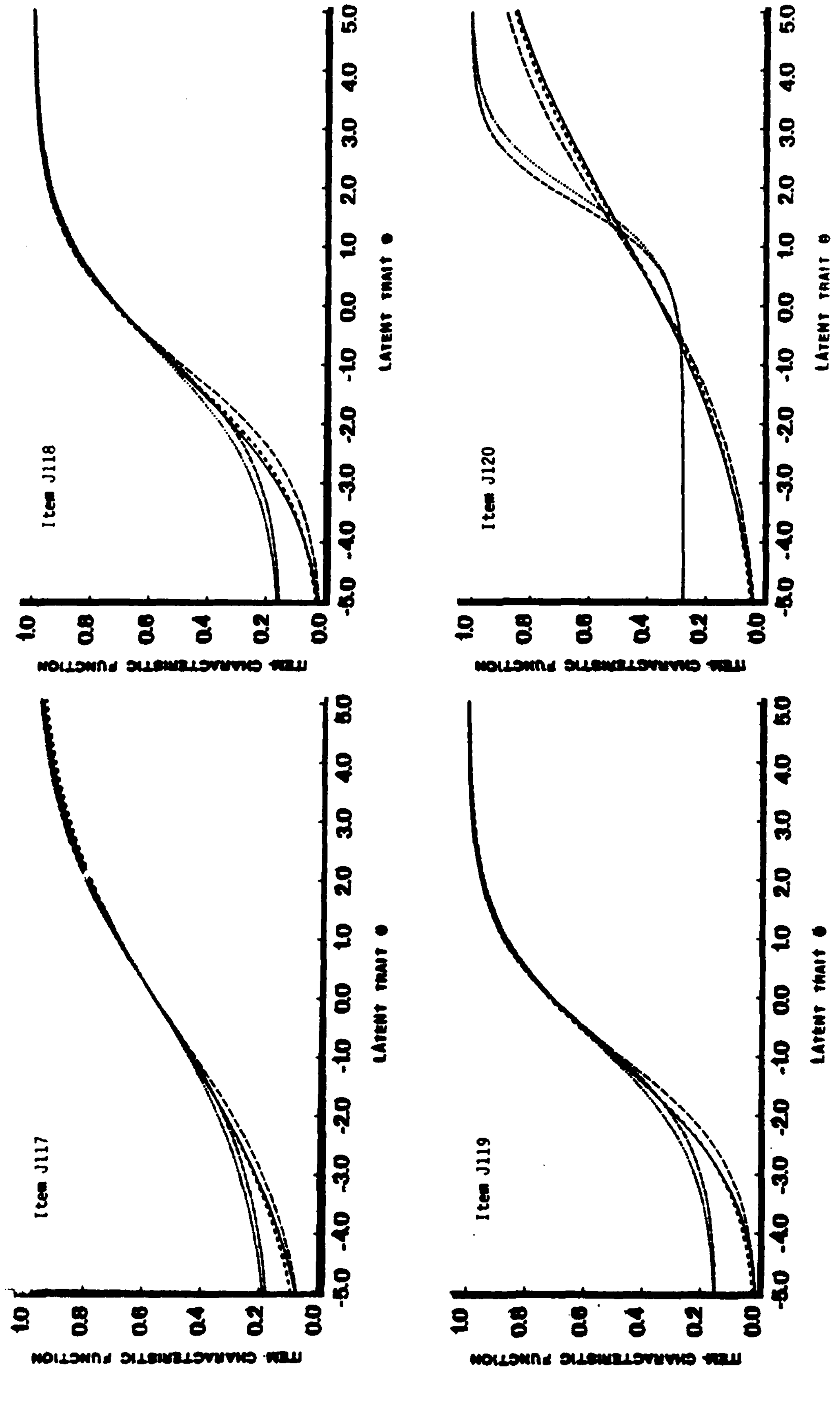

FIGURE 9-5 (Continued)

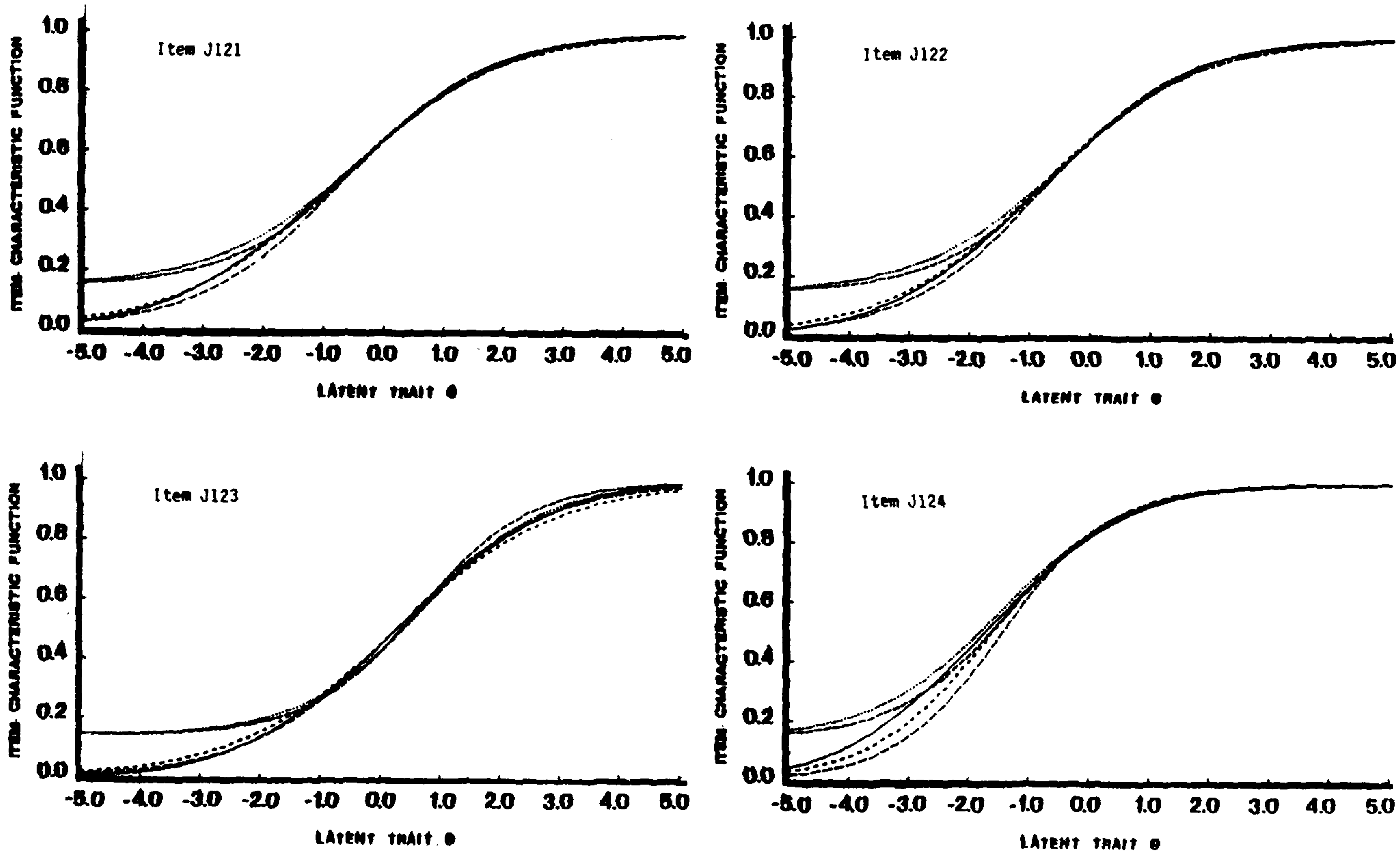

FIGURE 9-5 (Continued)

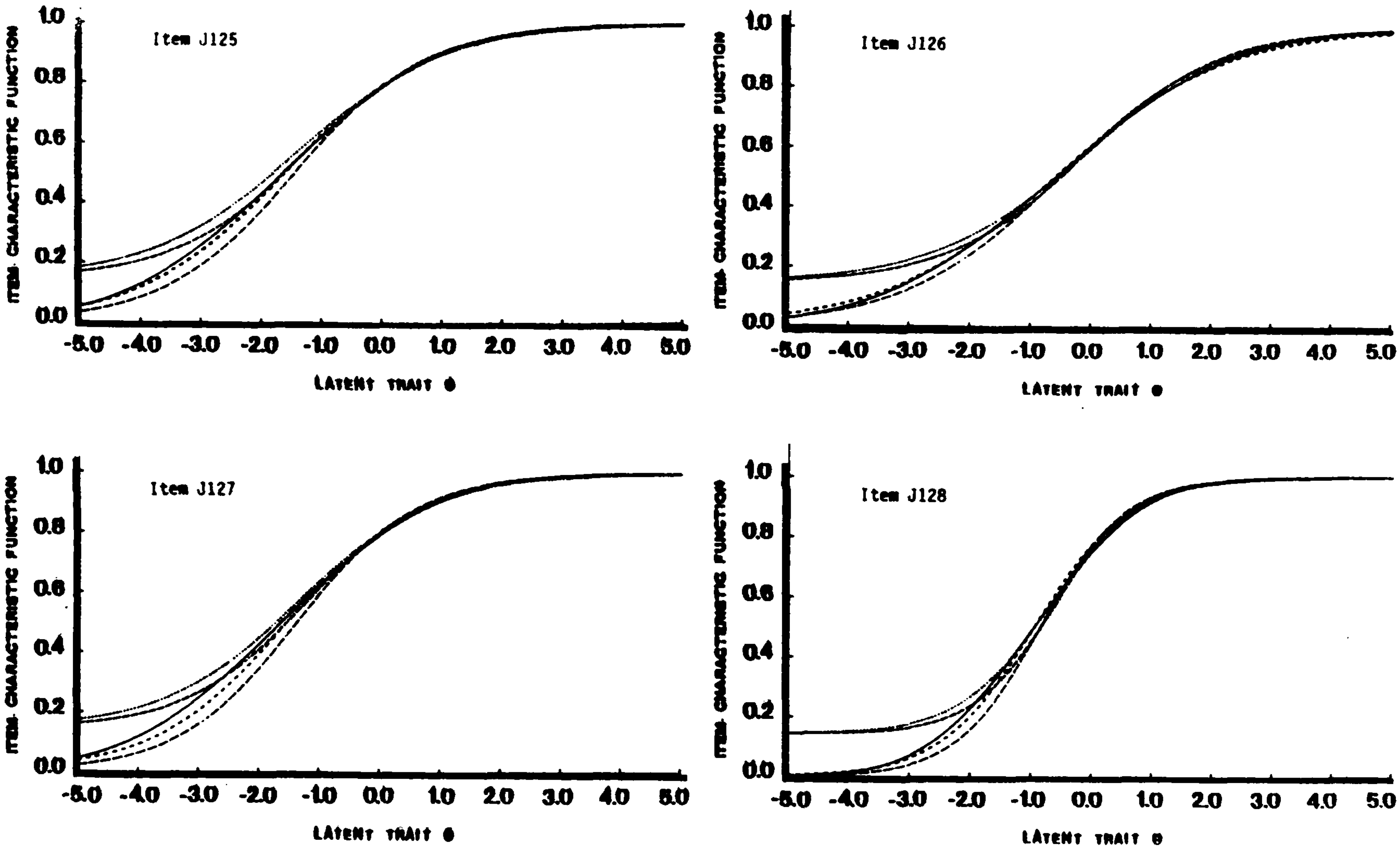

FIGURE 9-5 (Continued)

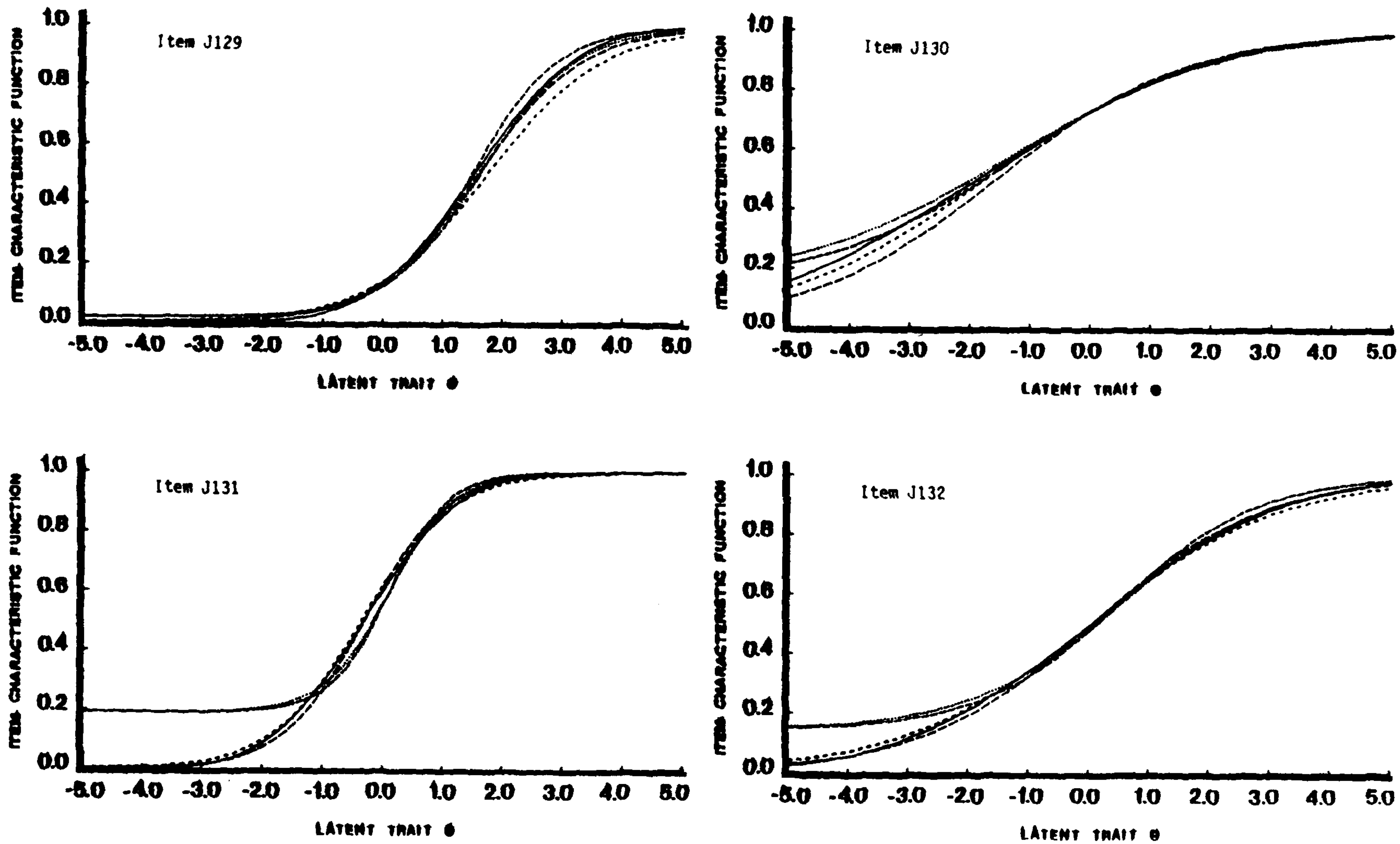

FIGURE 9-5 (Continued)

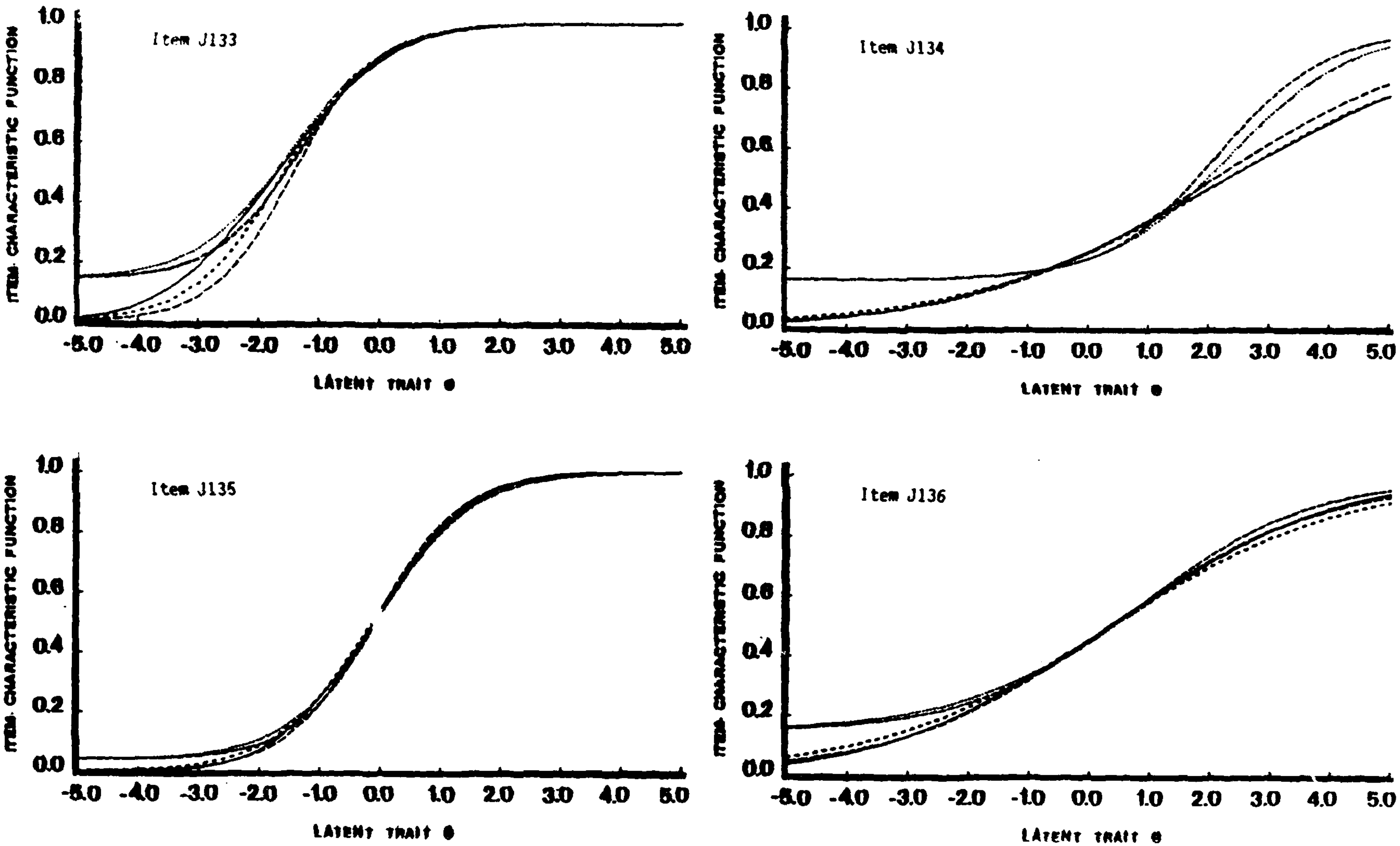

FIGURE 9-5 (Continued)

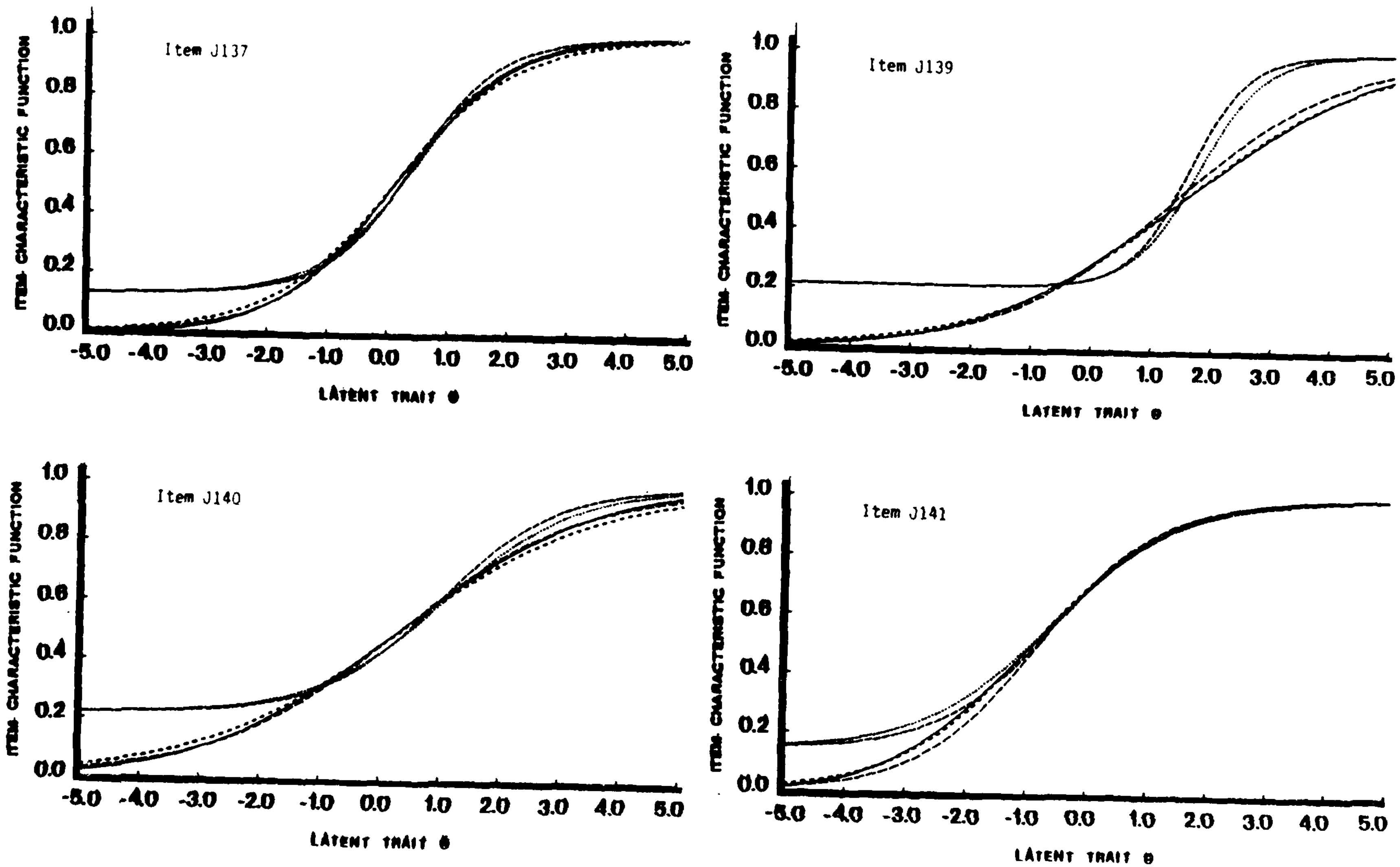

FIGURE 9-5 (Continued)

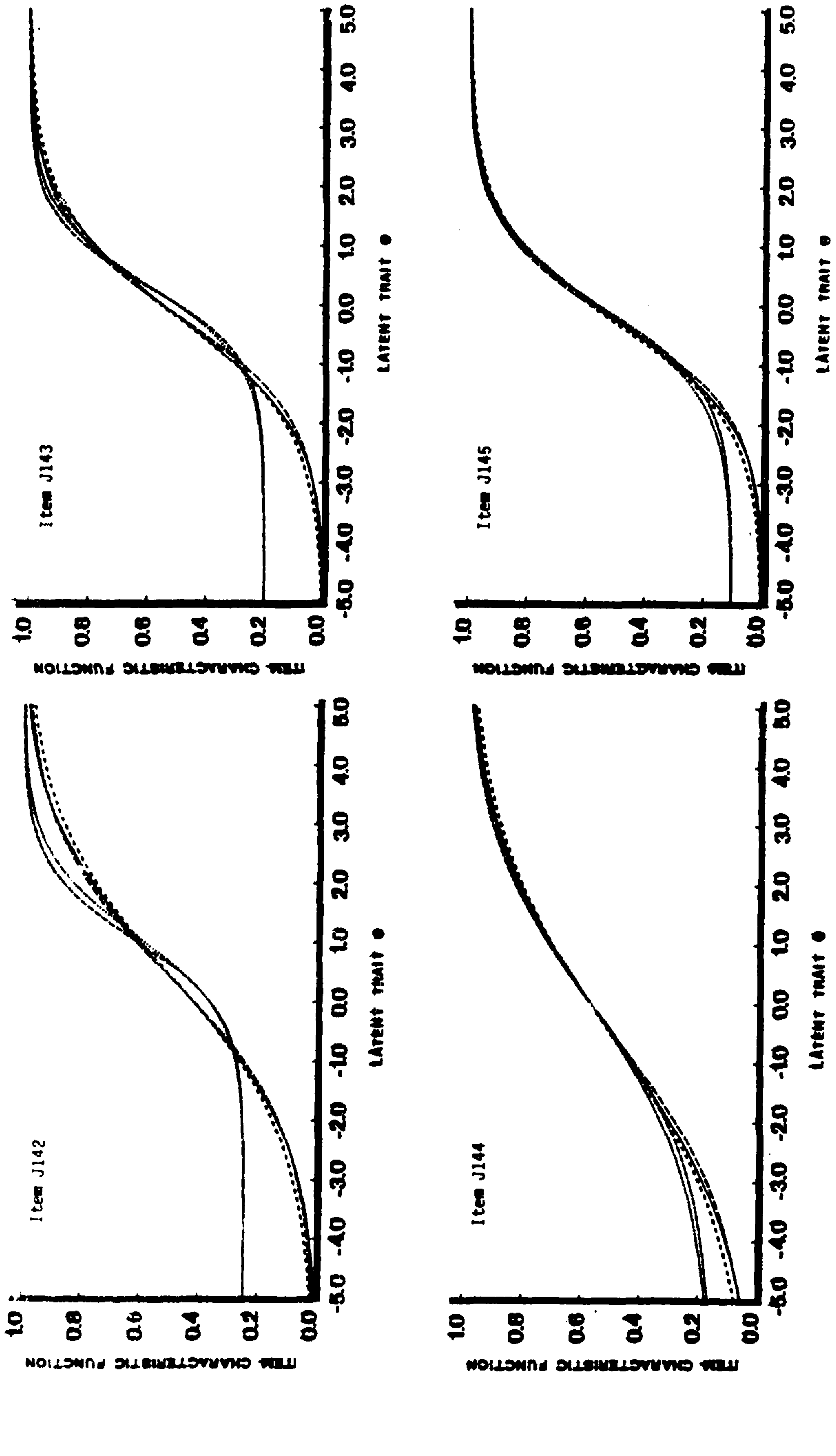

FIGURE 9-5 (Continued)

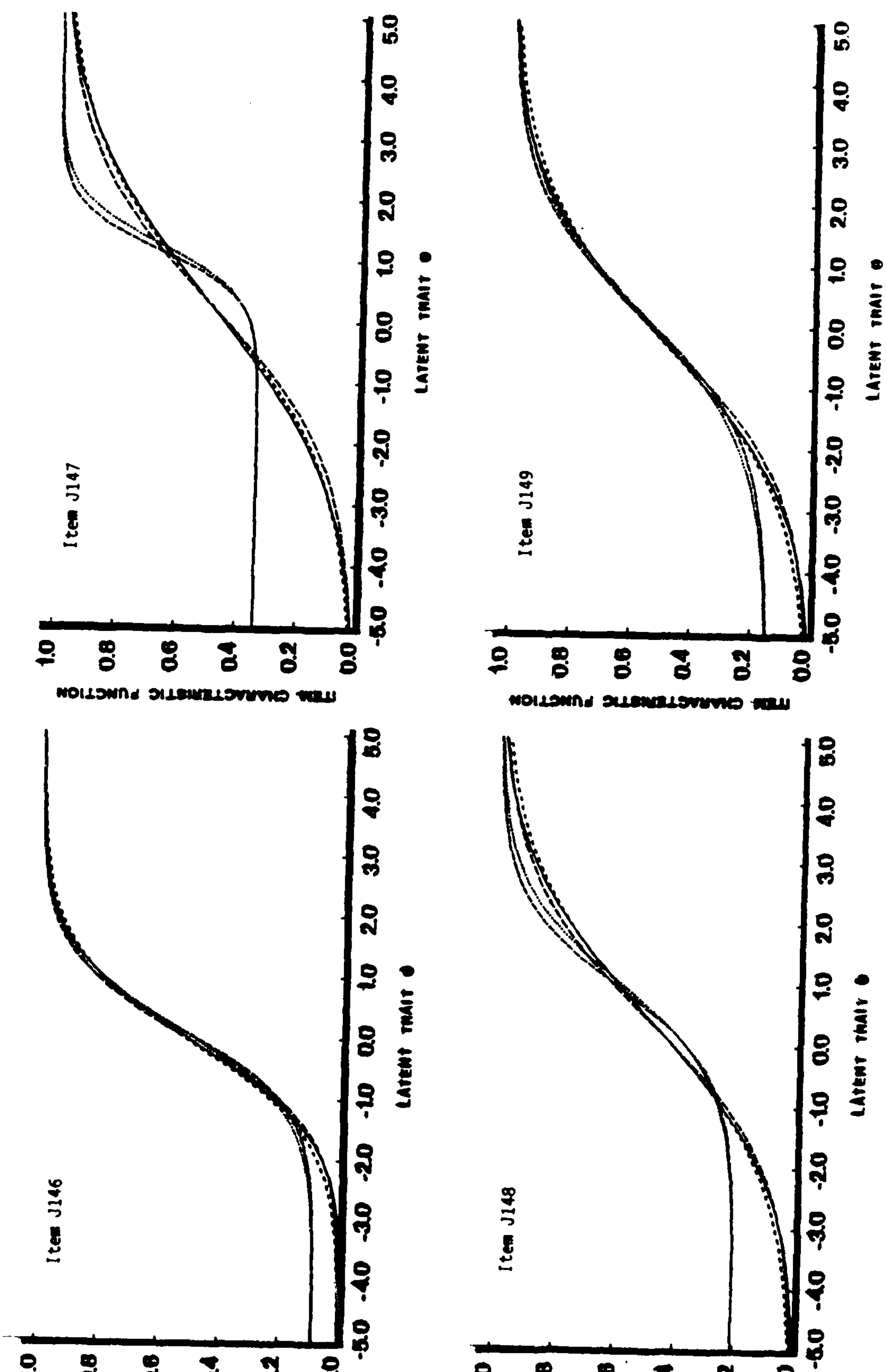

FIGURE 9-5 (Continued)

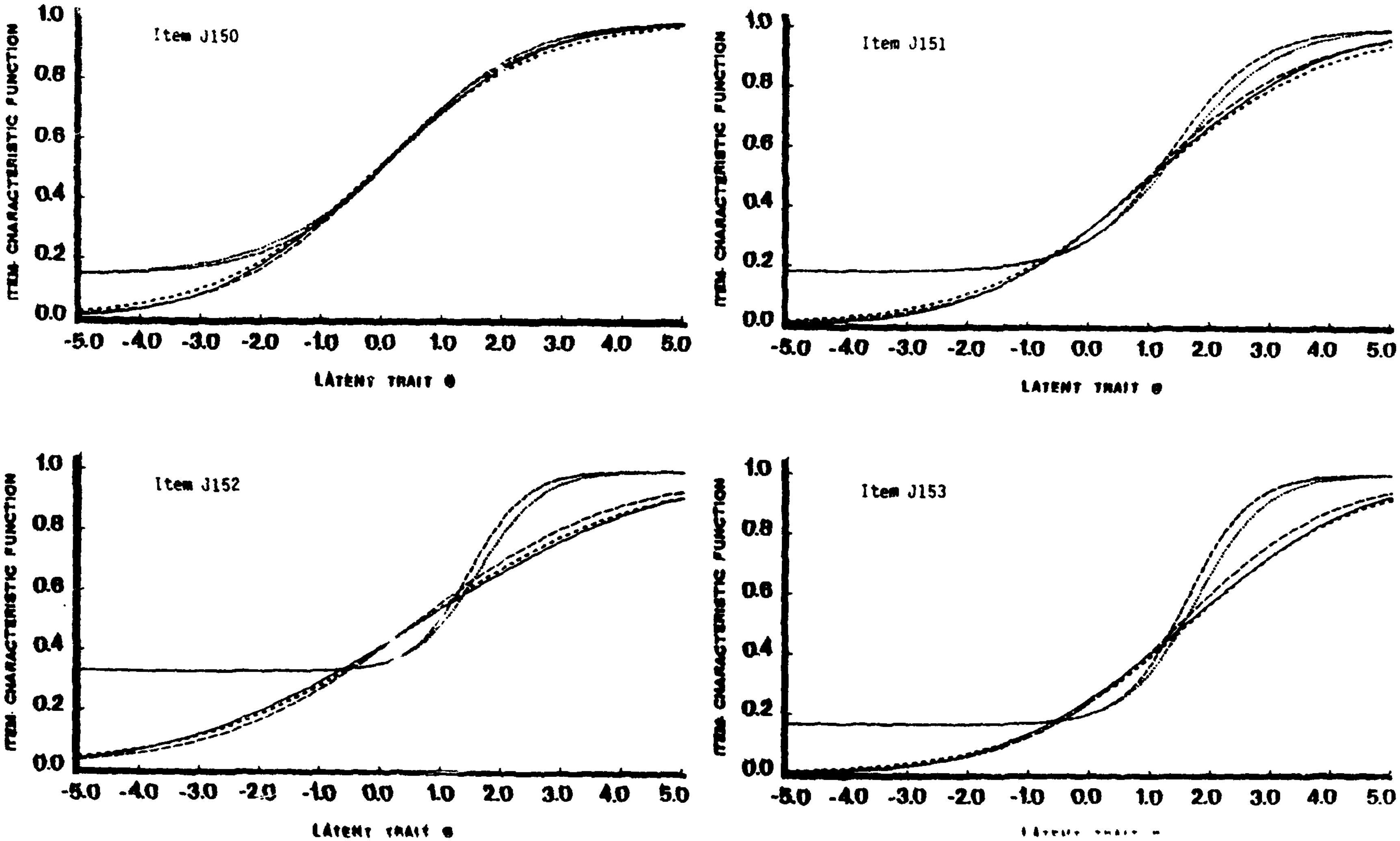

FIGURE 9-5 (Continued)

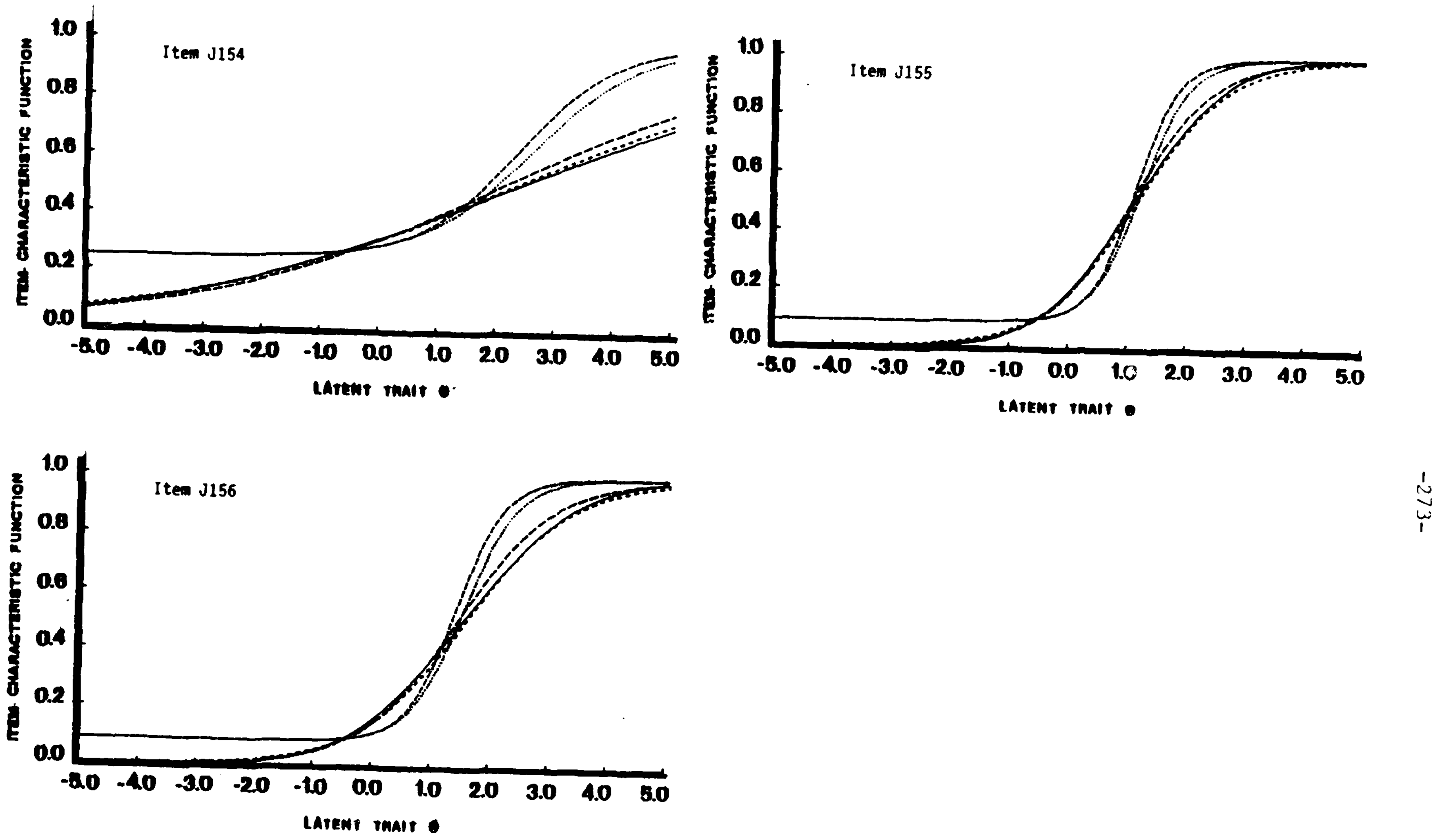

FIGURE 9-5 (Continued)

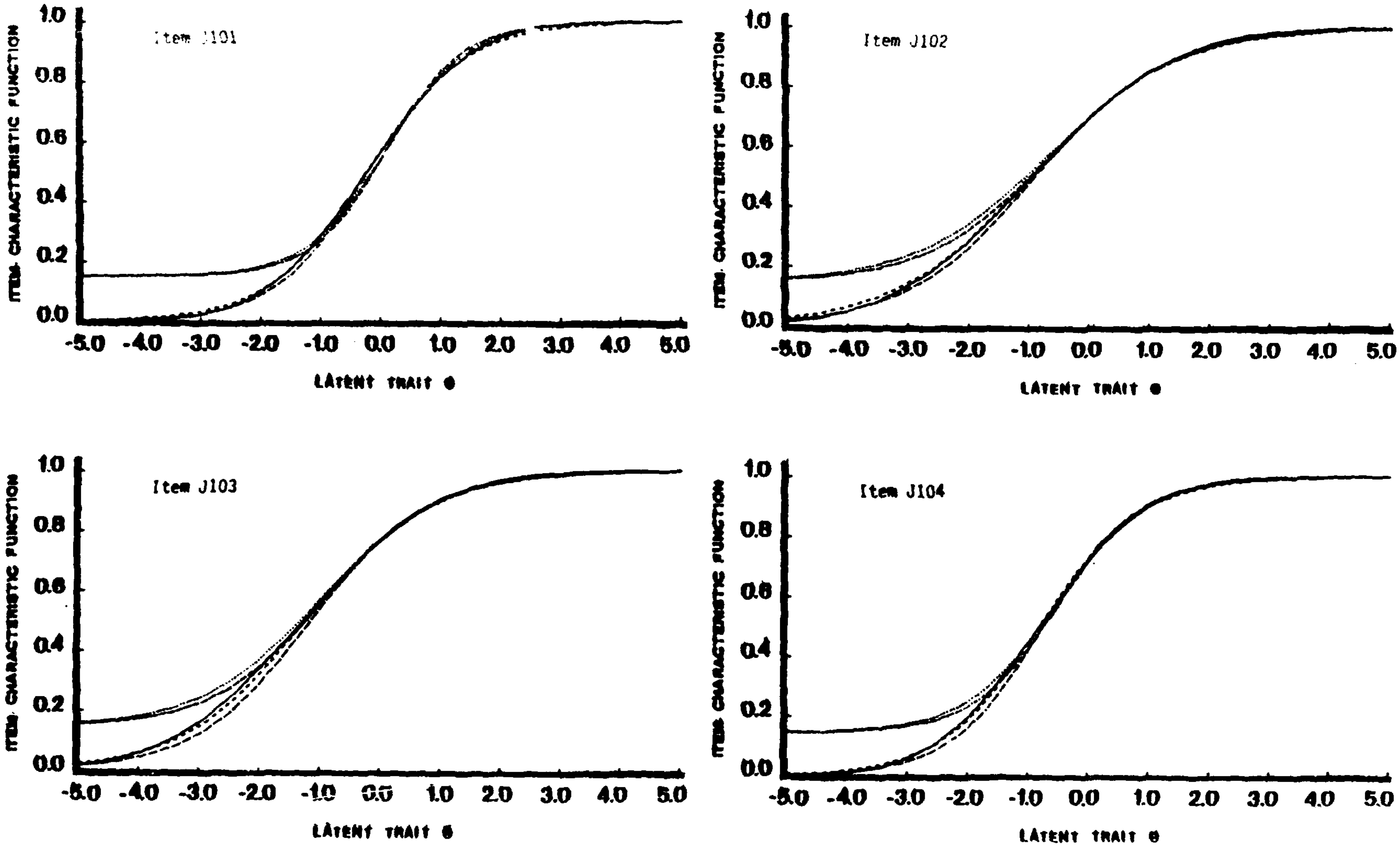

FIGURE 9-6

Estimated Item Characteristic Function in the Normal Ogive Model Obtained by the Tetrachoric Method (Solid Line), Two Estimated Item Characteristic Functions Following the Logistic Model Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Long Dashed Line) and the Second Scale Adjustment (Short Dashed Line), And Two Estimated Item Characteristic Functions Following the *Three-Parameter Logistic Model* Obtained by Using LOGIST 5, Which Are Based upon the First Scale Adjustment (Dashed Line of Medium Length) and the Second Scale Adjustment (Dotted Line), for Each Item of Test J1. Results of the J1/2259 Case.

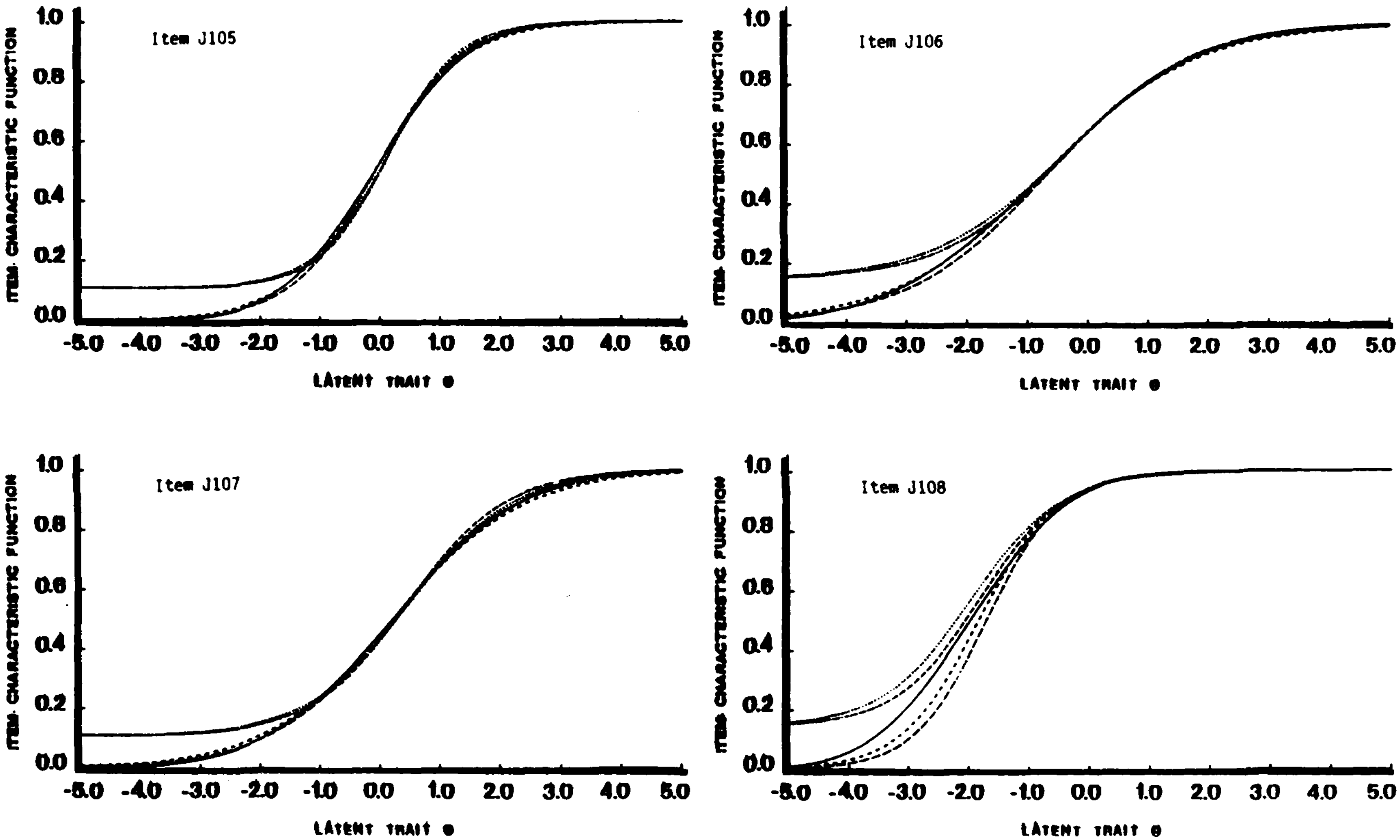

FIGURE 9-6 (Continued)

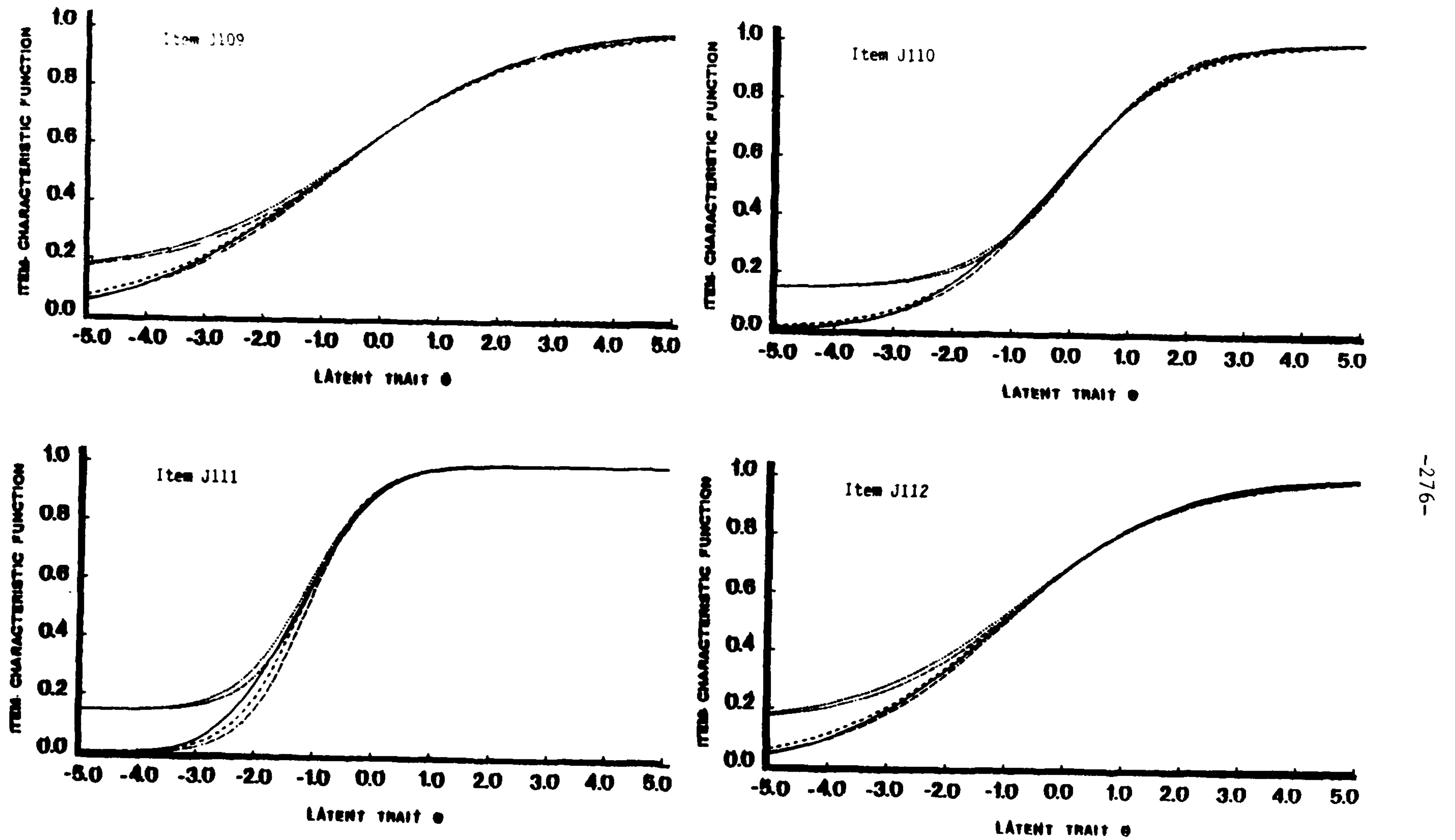

FIGURE 9-6 (Continued)

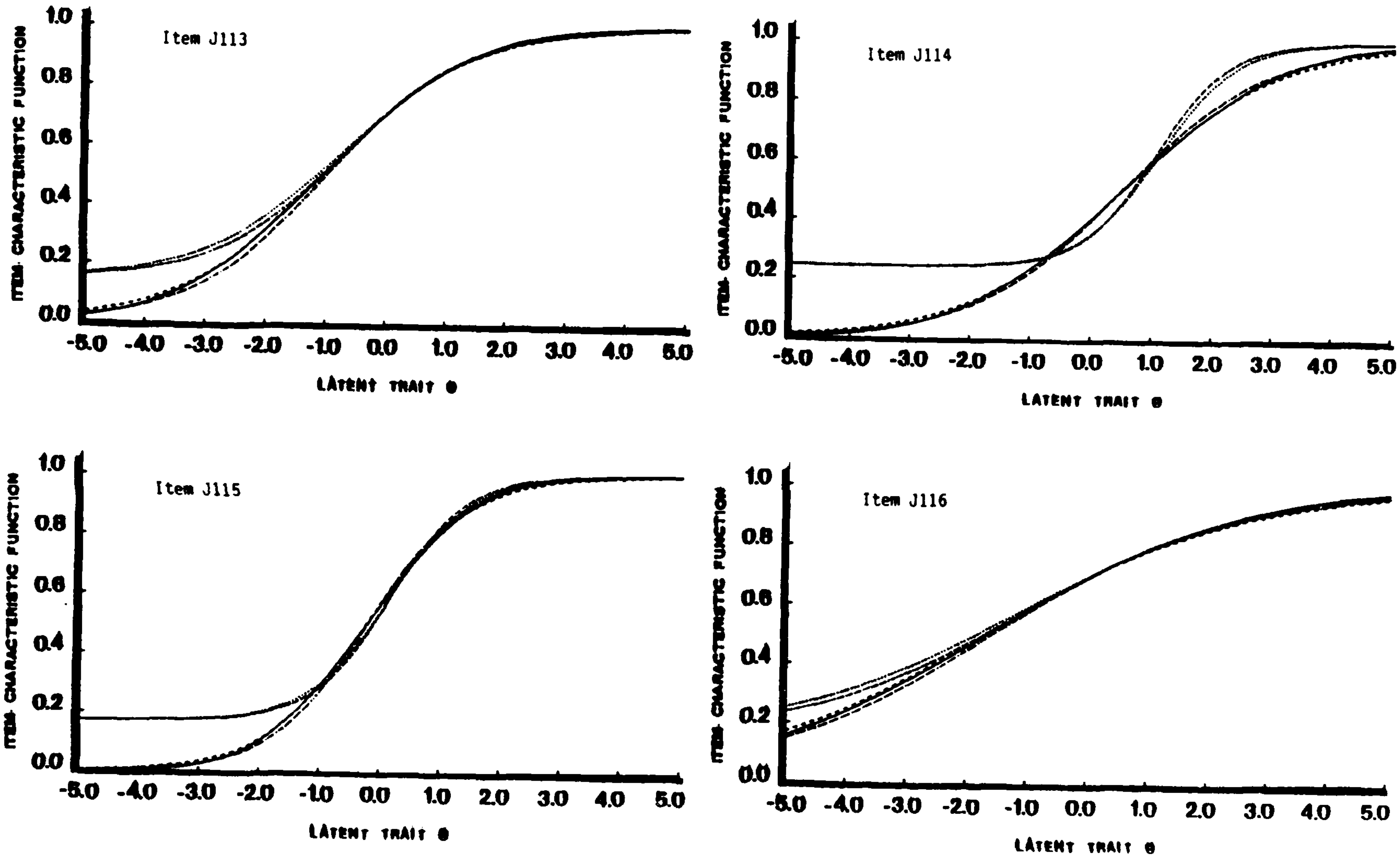

FIGURE 9-6 (Continued)

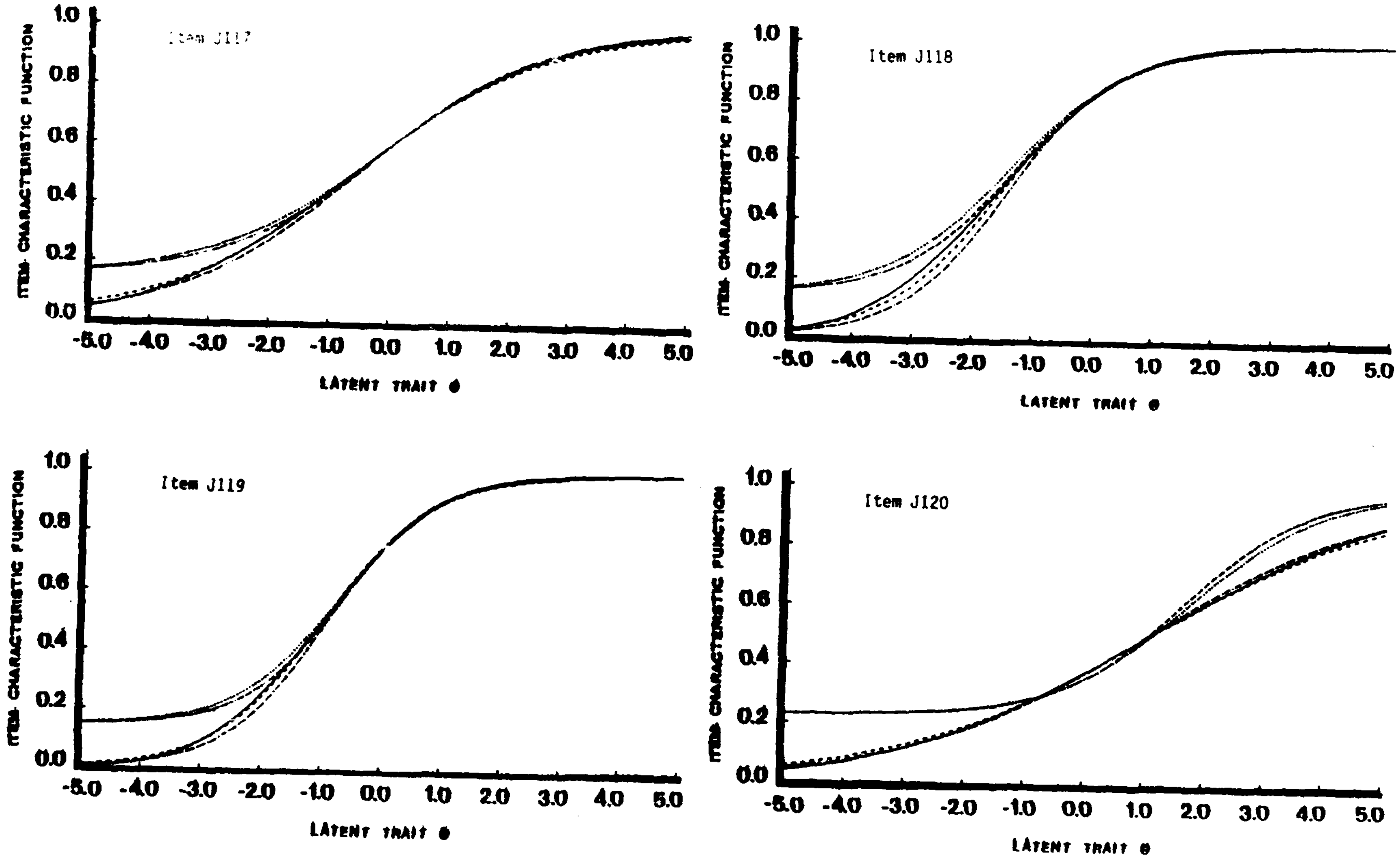

FIGURE 9-6 (Continued)

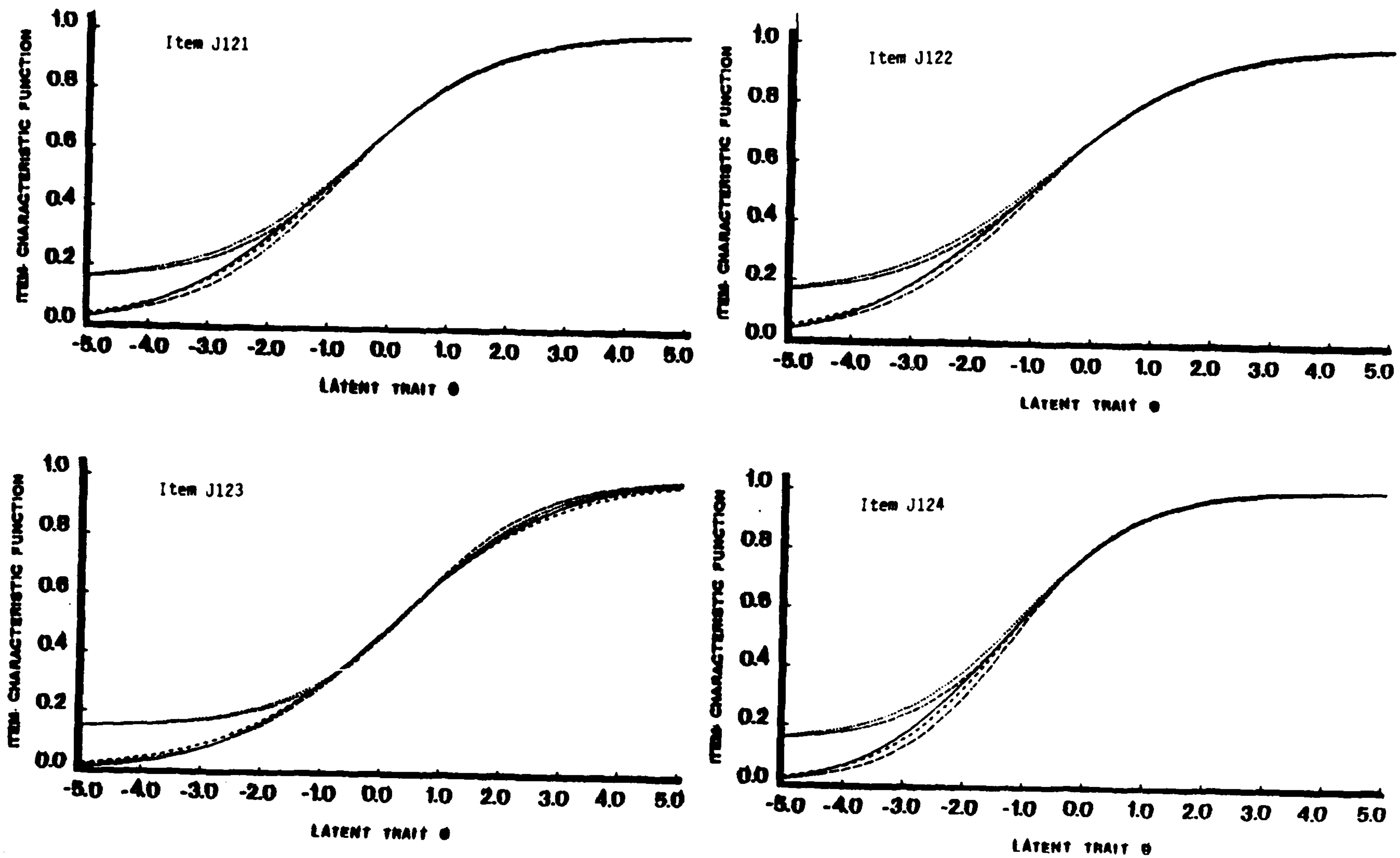

FIGURE 9-6 (Continued)

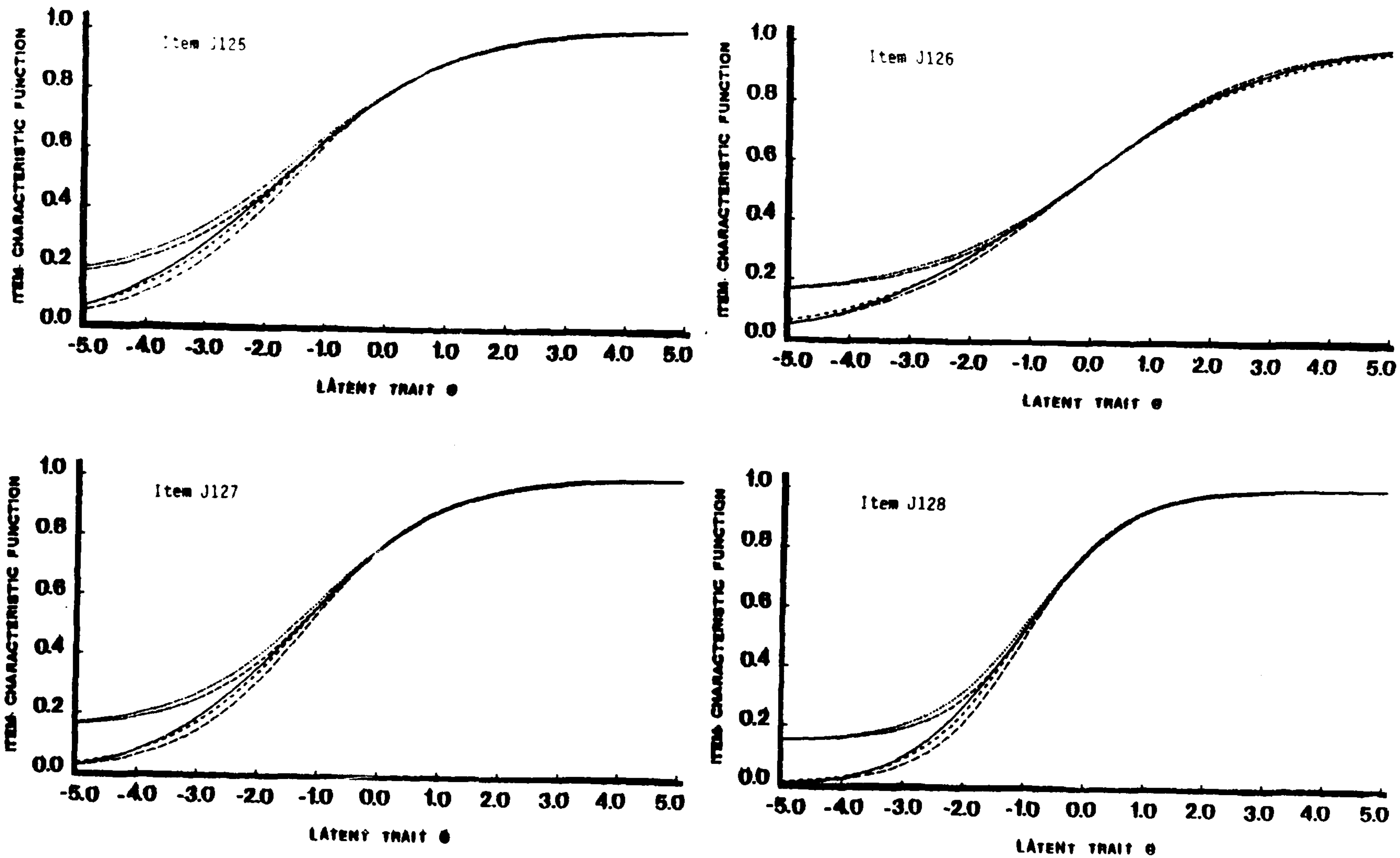

FIGURE 9-6 (Continued)

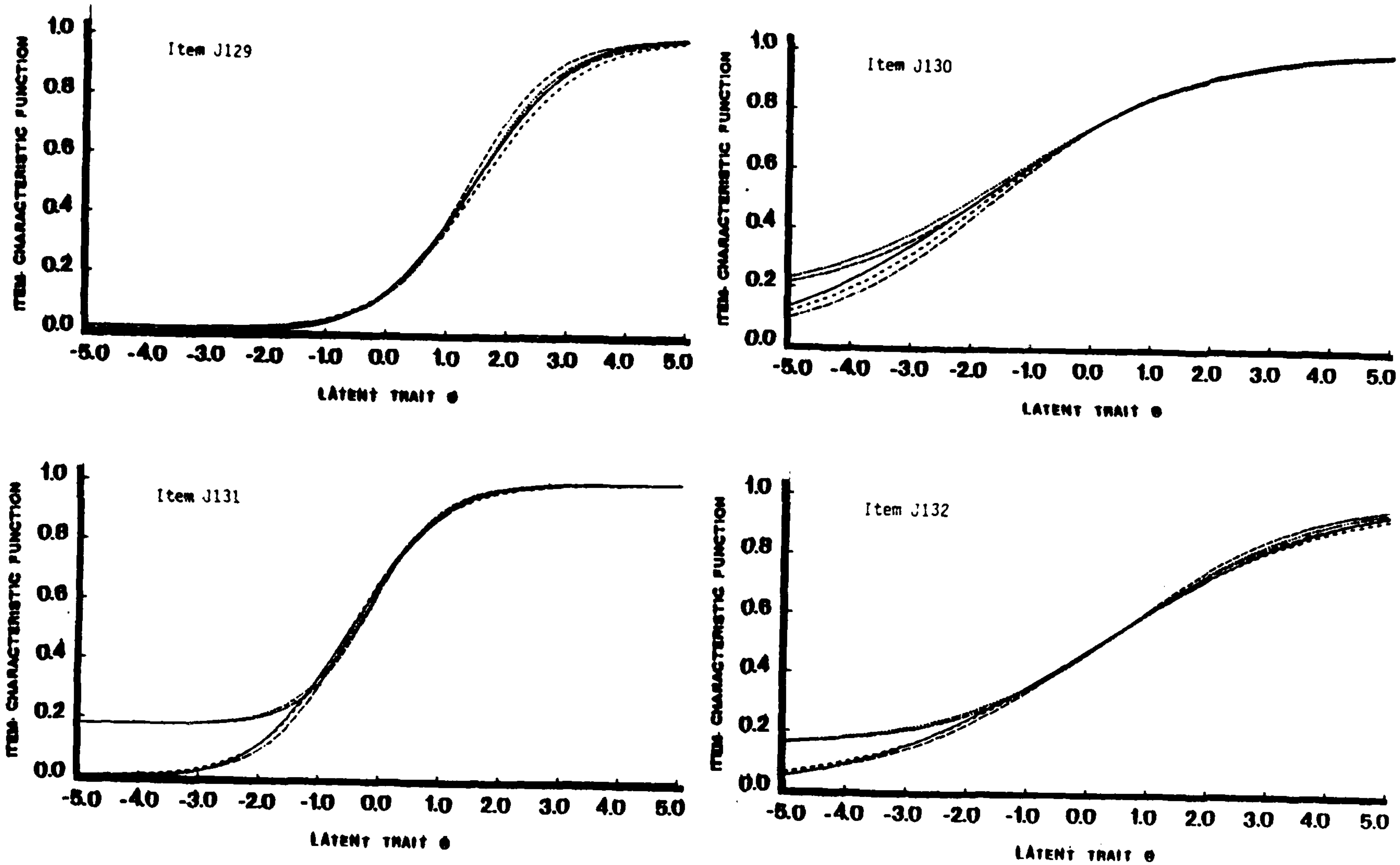

FIGURE 9-6 (Continued)

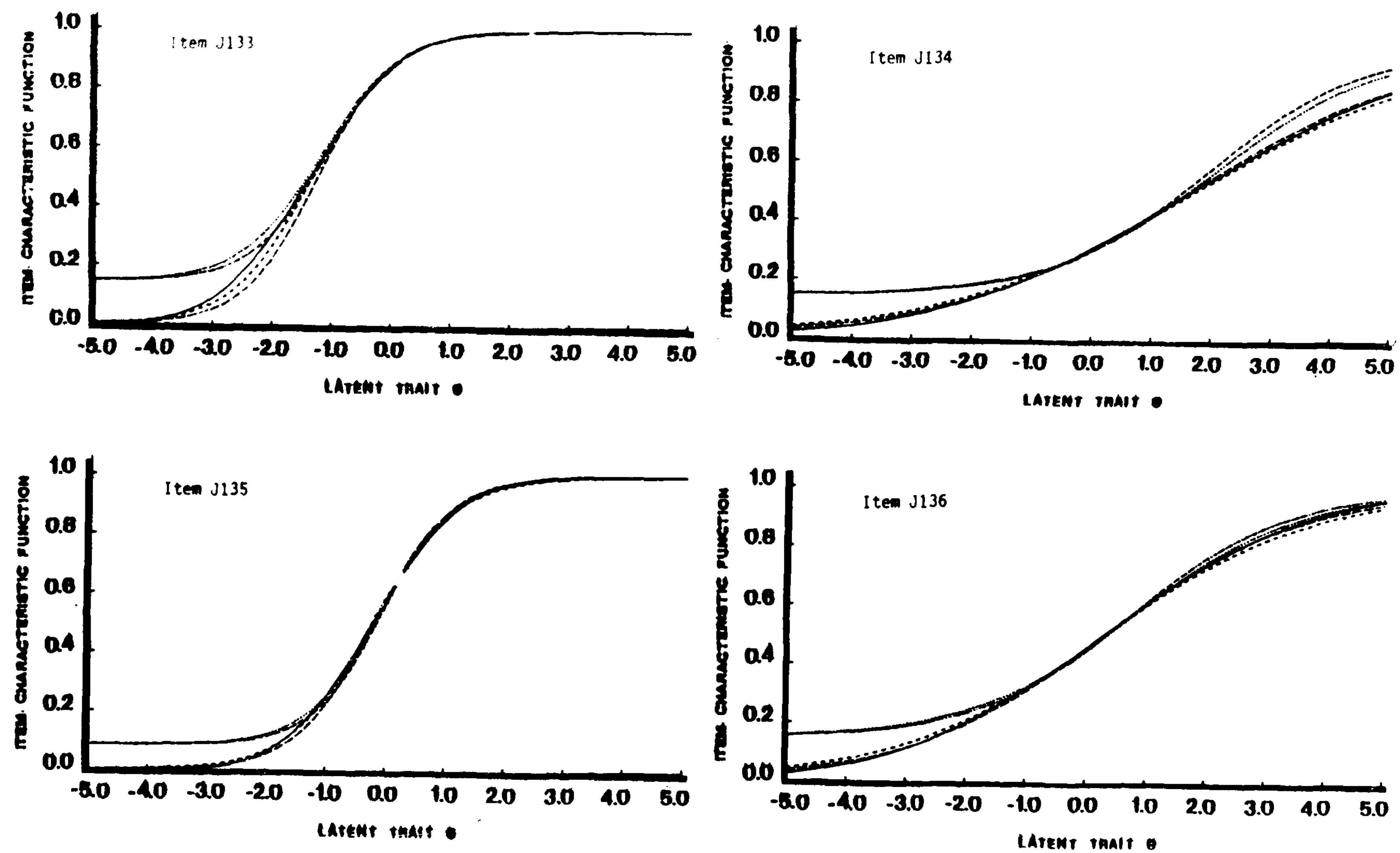

FIGURE 9-6 (Continued)

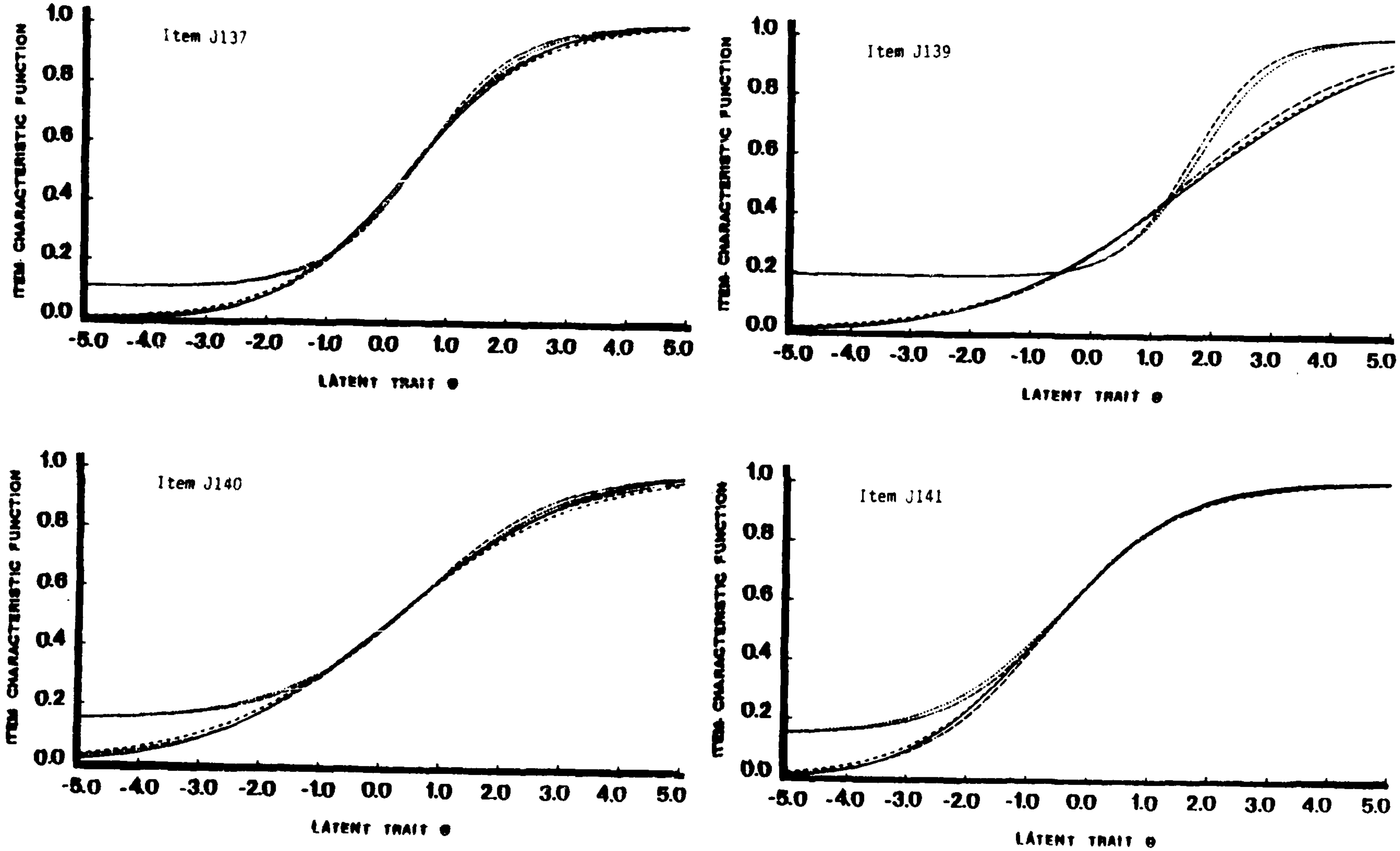

FIGURE 9-6 (Continued)

AD-A164 186 COMPARISON OF THE ESTIMATED ITEM PARAMETERS OF SHIBA'S WORD/PHASE COMPREH.. (U) TENNESSEE UNIV KNOXVILLE F SAMEJIMA 13 DEC 85 RR-84-2 N00014-81-C-0569 4/4

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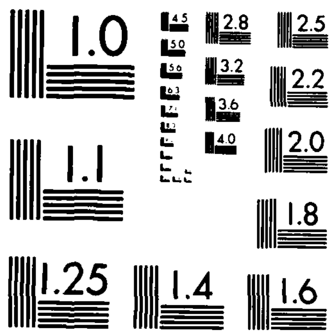

MICROCOPY RESOLUTION TEST CHART

ARDS-1963-A

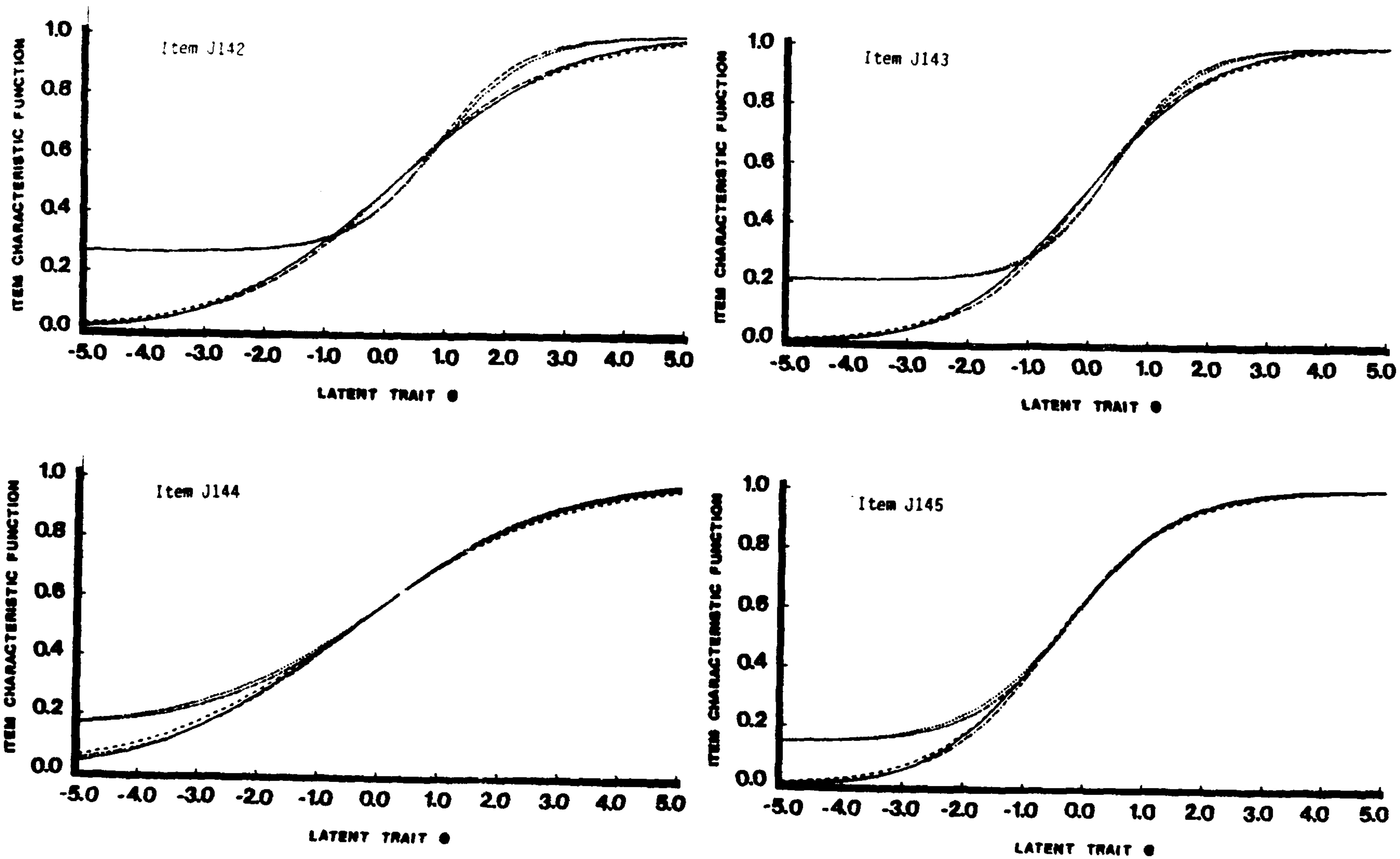

FIGURE 9-6 (Continued)

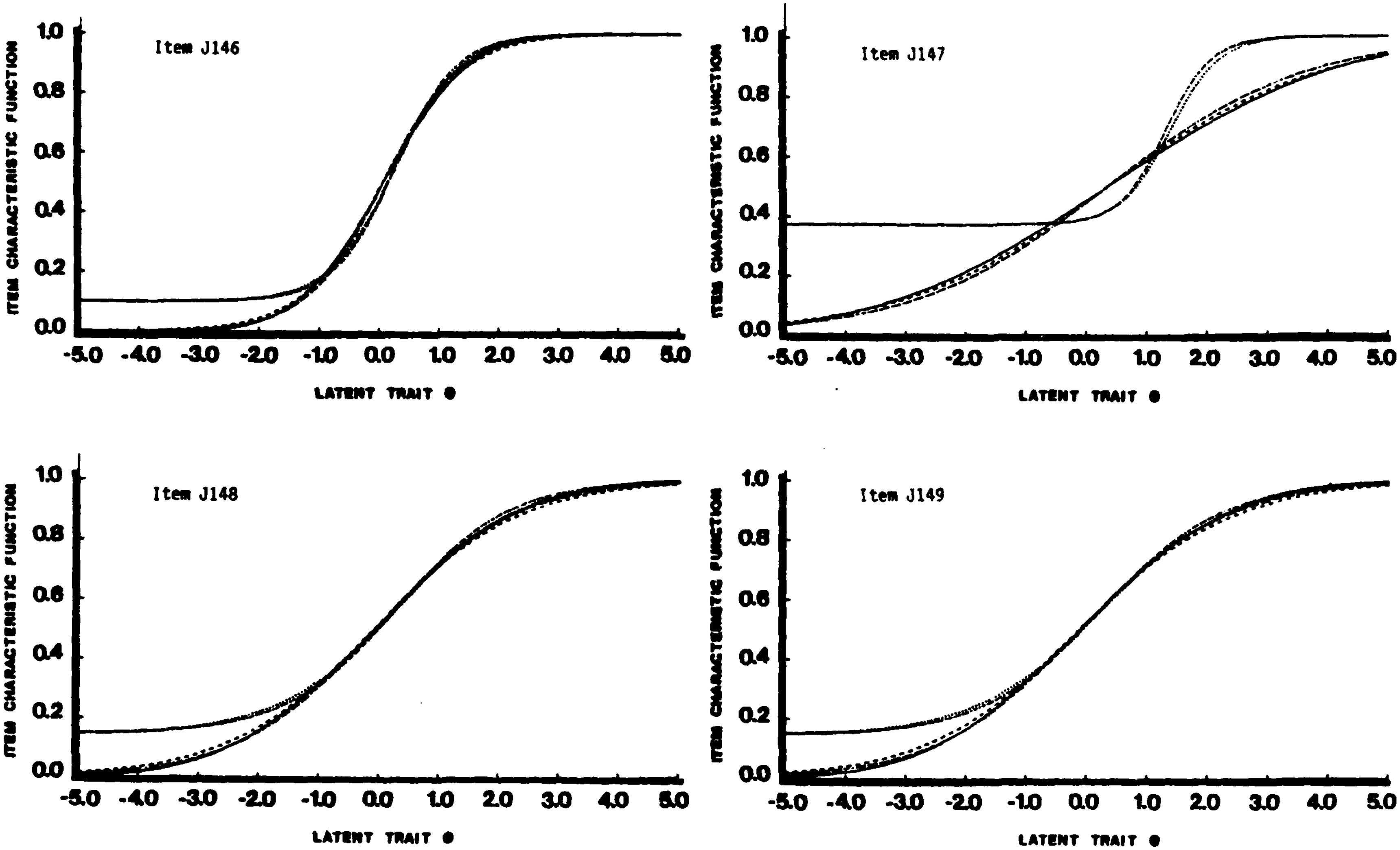

FIGURE 9-6 (Continued)

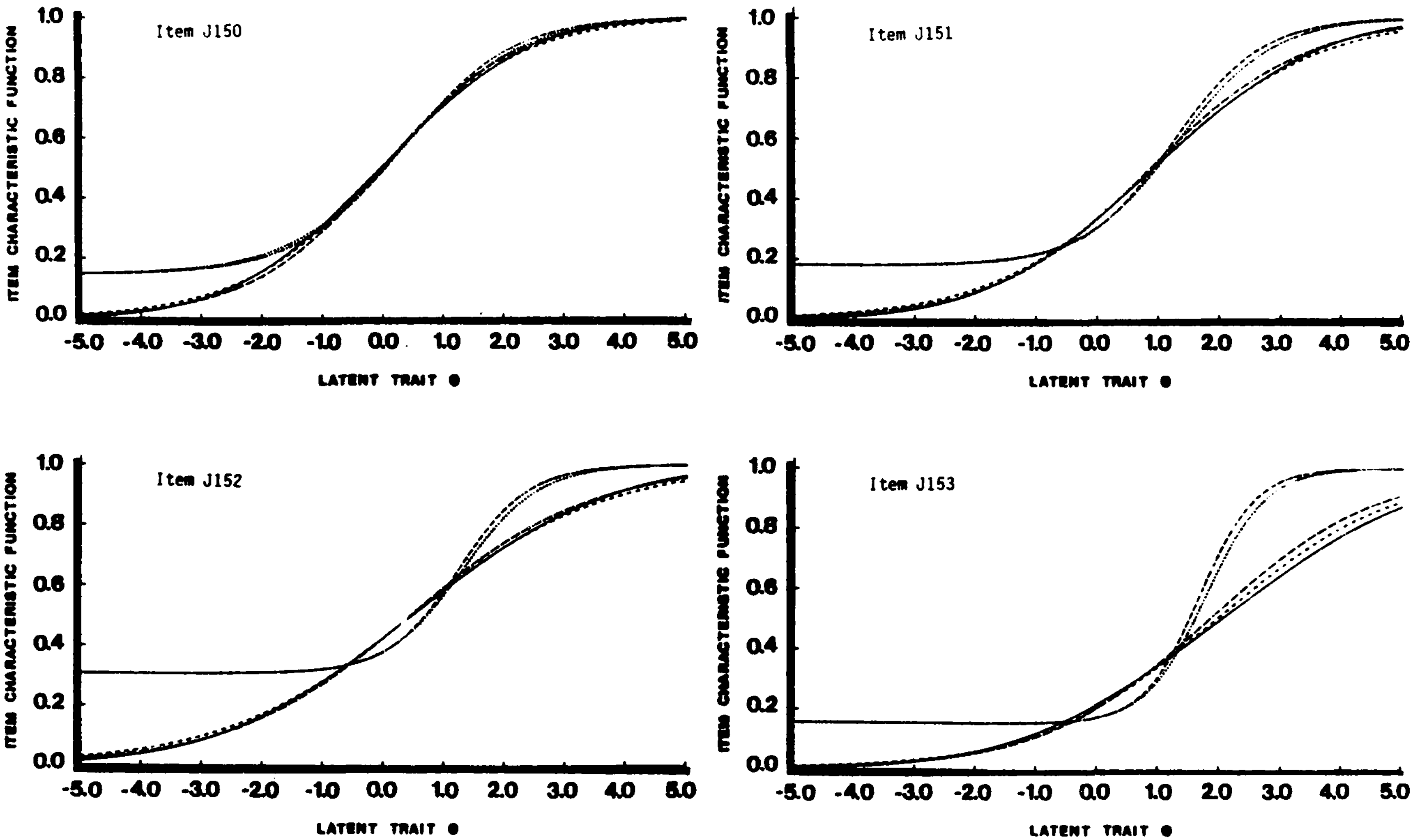

FIGURE 9-6 (Continued)

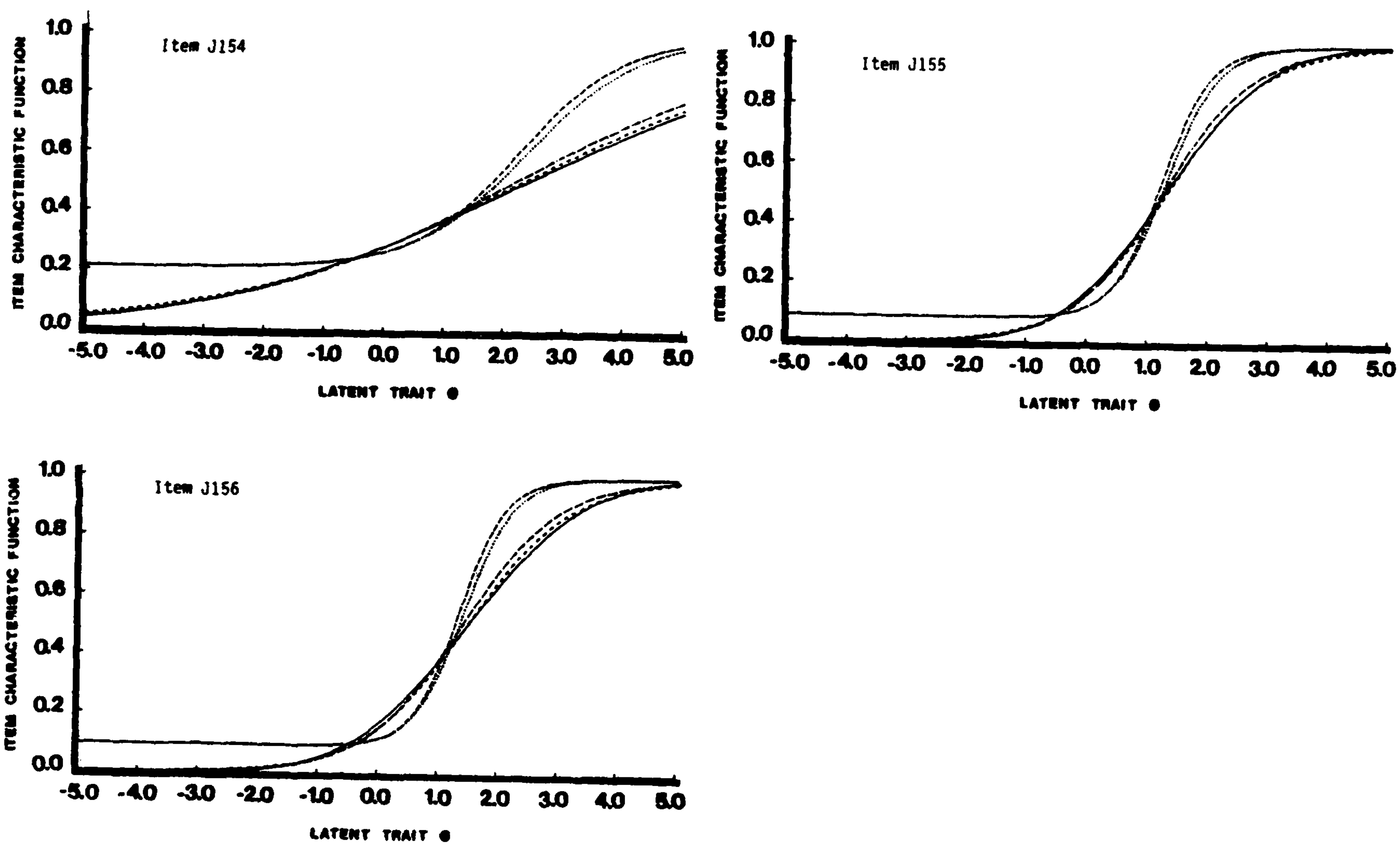

FIGURE 9-6 (Continued)

close to the normal ogive curve, which is drawn by a solid line.

(4) For certain items, the three-parameter logistic curves are drastically different from the other three curves, whereas for many other items they are close to the other three for the range of θ , $(-1.0, \infty)$.

X. Discussion and Conclusions

Data based upon Shiba's Word/Phrase Comprehension Tests A5, A6, J1 and J2 were analyzed, and the item discrimination and the item difficulty parameters of each item of these tests were estimated by two methods, i.e., Tetrachoric Method and Logist 5 . Scale adjustment, or equating, was made in the effort of putting all the estimated item characteristic functions on a single scale of θ . In this process, it was found out that the mean and the standard deviation of the distribution of the maximum likelihood estimate $\hat{\theta}$ seem to be somewhat different from those of the distribution of θ , and a certain systematic tendency has been observed. Further investigation of this tendency will be done in separate paper.

It has been observed by using simulated data (Samejima, ONR/RR-84-3) that the estimated item characteristic functions obtained by Logist 5 by assuming three-parameter logistic model can be drastically different from the true item characteristic function, when the latter follows normal ogive model. This is caused from the fact that in Logist 5 the maximum likelihood estimate $\hat{\theta}$ is treated as if it were θ itself in estimating the item parameters, and especially

on the lower side of θ the maximum likelihood estimate contains a substantial amount of error (Samejima, 1973; Lord, 1980). More detailed observation and discussion of this problem will be made, again, in a separate paper.

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APPENDIX

TABLE A-1

Intermediate Results for Obtaining the Best Fitted Linear Relationships between the Two Sets of Estimated Item Discrimination Parameters of the Overlapping Test Items And between Those of Estimated Difficulty Parameters, Which Were Obtained by Tetrachoric Method. For 14 Overlapping Items of Tests A5 And A6, A5/0599 and A6/0412 Cases.

TITLE: SHIBA'S DATA
A5-0599 VS A6-0412 (TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.95380000D 01	0.68128571D 00	0.71331080D 01	0.50950771D 00	0.45357490D-01	0.21297298D 00
2	0.80030000D 01	0.57164286D 00	0.49577170D 01	0.35412264D 00	0.27347087D-01	0.16536955D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.8409230123745D 00
2	0.8409230123745D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.4535748979592D-01	0.2961667346939D-01
2	0.2961667346939D-01	0.2734708673469D-01

CROSS PRODUCT MATRIX

1	0.5095077142857D 00	0.4190687857143D 00
2	0.4190687857143D 00	0.3541226428571D 00

C **********

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 2 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C **********

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITERATION 0

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.199495253067

WEIGHTED CROSS-PRODUCT MATRIX

1	0.5095077142857D 00	0.5026710191729D 00
2	0.5026710191729D 00	0.5095077143710D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE (REAL PART)	EIGENVALUE (IMAGINARY PART)	EIGENVECTOR (REAL PART)	EIGENVECTOR (IMAGINARY PART)
1	0.68366951555515D-02	0.0000000000000D 00	-0.7071067812165D 00	0.0000000000000D 00
			0.7071067811565D 00	0.0000000000000D 00
2	0.1012178733501D 01	0.0000000000000D 00	-0.7071067811565D 00	0.0000000000000D 00
			-0.7071067812165D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.019015428657

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 1.019015428657

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000085D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.8336839996056D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = 0.3665857982987D-02

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	0.831646872746	0.005053723411
2	1.202433427902	0.833711740337	0.003646958619
3	1.199455341237	0.833683622317	0.003666115025
4	1.199495795805	0.833684004736	0.003665854488
5	1.199495245584	0.833683999535	0.003665858031
6	1.199495253067	0.833683999606	0.003665857983

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.85950000D 01	-0.61392857D 00	0.93064810D 01	0.66474864D 00	0.28784035D 00	0.53650755D 00
2	-0.10240000D 01	-0.73142857D-01	0.49998740D 01	0.35713386D 00	0.35178398D 00	0.59311380D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.7401978051847D 00
2	0.7401978051847D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.287840352040[illegible] 00	0.2355383673469D 00
2	0.2355383673469D 00	0.3517839795918D 00

CROSS PRODUCT MATRIX

1	0.6647486428571D 00	0.2804428571429D 00
2	0.2804428571429D 00	0.3571338571429D 00

C **********

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 2 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C **********

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

ITERATION 22

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.904560896885

WEIGHTED COVARIANCE MATRIX

1	0.2878403520408D 00	0.2130587968182D 00
2	0.2130587968182D 00	0.2878403520246D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE (REAL PART)	EIGENVALUE (IMAGINARY PART)	EIGENVECTOR (REAL PART)	EIGENVECTOR (IMAGINARY PART)
1	0.5008991488509D 00	0.0000000000000D 00	0.7071067812000D 00 0.7071067811731D 00	0.0000000000000D 00 0.0000000000000D 00
2	0.7478155521452D-01	0.0000000000000D 00	-0.7071067811731D 00 0.7071067812000D 00	0.0000000000000D 00 0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.575680704065

SUM OF DIAGONALS OF COVARIANCE MATRIX = 0.575680704065

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999619D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.1105508764977D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = 0.6055605596413D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = -0.5477664029682D 00

TABLE A-1 (Continued): A5/0599 And A6/0412 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	1.144909832698	0.629750000860	-0.550043315967
2	0.873431227020	1.092011995305	0.597274507118	-0.546948668774
3	0.915740856601	1.110285061966	0.608492864828	-0.548051023717
4	0.900669597616	1.103837223938	0.604534352839	-0.547666213577
5	0.905930673757	1.106096058781	0.605921116088	-0.547801532495
6	0.904080610414	1.105302704579	0.605434053275	-0.547754068426
7	0.904729533238	1.105581099284	0.605604967739	-0.547770731728
8	0.904501714662	1.105483377479	0.605544973531	-0.547764883550
9	0.904581670219	1.105517675894	0.605566030308	-0.547766936262
10	0.904553605795	1.105505637364	0.605558639510	-0.547766215787
11	0.904563456035	1.105509862755	0.605561233599	-0.547766468668
12	0.904559998685	1.105508379683	0.605560323098	-0.547766379909
13	0.904561212179	1.105508900226	0.605560642675	-0.547766411063
14	0.904560786254	1.105508717521	0.605560530506	-0.547766400128
15	0.904560935750	1.105508781649	0.605560569876	-0.547766403966
16	0.904560883278	1.105508759140	0.605560556058	-0.547766402619
17	0.904560901695	1.105508767040	0.605560560908	-0.547766403092
18	0.904560895231	1.105508764268	0.605560559206	-0.547766402926
19	0.904560897500	1.105508765241	0.605560559803	-0.547766402984
20	0.904560896704	1.105508764899	0.605560559593	-0.547766402964
21	0.904560896983	1.105508765019	0.605560559667	-0.547766402971
22	0.904560896885	1.105508764977	0.605560559641	-0.547766402968

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	-0.54776640296820 00	S.D. OF POP. 2 =	0.90456089691950 00
SLOPE =	0.11055087649770 01	INTERCEPT =	0.60556055964130 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	-0.5 04113401253D 00	S.D. OF POP. 2 =	0.86839964672420 00
SLOPE =	0.11515435361730 01	INTERCEPT =	0.63382262095750 00

TABLE A-1 (Continued):

For 14 Overlapping Items of Tests A6 and J1, A6/0412 And J1/0614 Cases.

TITLE: SHIBA'S DATA
A6-0412 VS. J1-0614(TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.86120000D 01	0.61514286D 00	0.55404400D 01	0.39574571D 00	0.17344980D-01	0.13170034D 00
2	0.85160000D 01	0.60828571D 00	0.56974460D 01	0.40696043D 00	0.36948918D-01	0.19222101D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.5235044981970D 00
2	0.5235044981970D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.1734497959184D-01	0.1325281632653D-01
2	0.1325281632653D-01	0.3694891836735D-01

CROSS PRODUCT MATRIX

1	0.3957457142857D 00	0.3874354285714D 00
2	0.3874354285714D 00	0.4069604285714D 00

C **********

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C **********

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITERATION 7

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.986125113863

WEIGHTED CROSS-PRODUCT MATRIX

1	0.3957457142857D 00	0.3820598061144D 00
2	0.3820598061144D 00	0.3957457143091D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1368590818301D-01	0.0000000000000D 00	-0.7071067811974D 00	0.0000000000000D 00
			0.7071067811757D 00	0.0000000000000D 00
2	0.7778055204118D 00	0.0000000000000D 00	-0.7071067811757D 00	0.0000000000000D 00
			-0.7071067811974D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.791491428595

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.791491428595

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000031D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1014070107305D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1551226886493D-01

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.014577739339	-0.015824535085
2	0.985631717735	1.014051927940	-0.015501085958
3	0.986142792541	1.014070758520	-0.015512669455
4	0.986124480564	1.014070083976	-0.015512254515
5	0.986125136518	1.014070108139	-0.015512269378
6	0.986125113021	1.014070107274	-0.015512268846
7	0.986125113863	1.014070107305	-0.015512268865

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.94800000D 01	-0.67714286D 00	0.88560460D 01	0.63257471D 00	0.17405227D 00	0.41719572D 00
2	-0.37210000D 01	-0.26578571D 00	0.47963270D 01	0.34259479D 00	0.27195274D 00	0.52149088D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000D 01	0.84674534295950D 00
2	0.84674534295950D 00	0.10000000000000D 01

COVARIANCE MATRIX

1	0.17405226530610D 00	0.18422110204080D 00
2	0.18422110204080D 00	0.27195273979590D 00

CROSS PRODUCT MATRIX

1	0.63257471428570 00	0.36419600000000D 00
2	0.36419600000000D 00	0.34259478571430D 00

C **********

NOTE : THE FOLLOWING 2 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 14

THUS THE RESULTING NUMBER OF ITEMS IS 14

C **********

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

ITERATION 14

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.800005772627

WEIGHTED COVARIANCE MATRIX

1	0.17405226530610 00	0.1473779450723D 00
2	0.1473779450723D 00	0.1740522652891D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.3214302103699D 00	0.0000000000000D 00	0.7071067812069D 00 0.7071067811662D 00	0.0000000000000D 00 0.0000000000000D 00
2	0.2667432022530D-01	0.0000000000000D 00	-0.7071067811662D 00 0.7071067812069D 00	0.0000000000000D 00 0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.348104530595

SUM OF DIAGONALS OF COVARIANCE MATRIX = 0.348104530595

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999423D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.1249990980264D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = 0.5806367494928D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = -0.4645127514203D 00

TABLE A-1 (Continued): A6/0412 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	1.300414682155	0.614780799059	-0.472757503814
2	0.768985473420	1.241081834236	0.574603984897	-0.462986379339
3	0.805748639948	1.251610256184	0.581733230616	-0.464787842495
4	0.798970761912	1.249698127475	0.580438446319	-0.464462923932
5	0.800193245084	1.250043991803	0.580672645878	-0.464521768582
6	0.799971846237	1.249981385820	0.580630252684	-0.464511119342
7	0.800011913253	1.249992716808	0.580637925381	-0.464513046815
8	0.800004661270	1.249990665975	0.580636536675	-0.464512697958
9	0.800005973820	1.249991037161	0.580636788020	-0.464512761099
10	0.800005736258	1.249990969979	0.580636742528	-0.464512749671
11	0.800005779255	1.249990982138	0.580636750762	-0.464512751739
12	0.800005771473	1.249990979937	0.580636749272	-0.464512751365
13	0.800005772882	1.249990980336	0.580636749542	-0.464512751433
14	0.800005772627	1.249990980264	0.580636749493	-0.464512751420

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0. S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = -0.46451275142030 00 S.D. OF POP. 2 = 0.80000577267290 00

SLOPE = 0.12499909802640 01 INTERCEPT = 0.58063674949280 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0. S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = -0.43774945038560 00 S.D. OF POP. 2 = 0.90070080478420 00

SLOPE = 0.'11024659319500 01 INTERCEPT = 0.48600983596370 00

TABLE A-1 (Continued):

For 16 Overlapping Items of Tests J2 and J1, J2/0758 And J1/0614 Cases.

TITLE: SHIBA'S DATA
J2-0758 VS. J1-0614(TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.80920000D 01	0.50575000D 00	0.44159780D 01	0.27599862D 00	0.20215563D-01	0.14218144D 00
2	0.11114000D 02	0.69462500D 00	0.83597860D 01	0.52248662D 00	0.39982734D-01	0.19995683D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.39975935731210 00
2	0.39975935731210 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.2021556250000D-01	0.1136521875000D-01
2	0.1136521875000D-01	0.3998273437500D-01

CROSS PRODUCT MATRIX

1	0.2759986250000D 00	0.3626718125000D 00
2	0.3626718125000D 00	0.5224866250000D 00

C **********

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 4 7 17

THUS THE RESULTING NUMBER OF ITEMS IS 16

C **********

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITERATION 9

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.726801592904

WEIGHTED CROSS-PRODUCT MATRIX

1	0.2759986250000D 00	0.2635904510264D 00
2	0.2635904510264D 00	0.2759986250041D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1240817397564D-01	0.0000000000000D 00	-0.7071067811893D 00	0.0000000000000D 00
			0.7071067811838D 00	0.0000000000000D 00
2	0.5395890760285D 00	0.0000000000000D 00	-0.7071067811838D 00	0.0000000000000D 00
			-0.7071067811893D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.551997250004

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.551997250004

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000008D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1375891315830D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1232032980777D-02

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.395984896675	-0.011394361494
2	0.716340128308	1.374952668070	-0.000757311876
3	0.727297763205	1.375935517220	-0.001254387834
4	0.726778244682	1.375889235142	-0.001230980673
5	0.726802692004	1.375891413775	-0.001232082517
6	0.726801541160	1.375891311218	-0.001232030649
7	0.726801595334	1.375891316046	-0.001232033090
8	0.726801592784	1.375891315819	-0.001232032975
9	0.726801592904	1.375891315830	-0.001232032981

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.863800000D 01	0.539875000D 00	0.123767700D 02	0.773548120D 00	0.482083110D 00	0.694322050D 00
2	-0.118540000D 02	-0.740875000D 00	0.146885140D 02	0.918032120D 00	0.369136360D 00	0.607565930D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.8162276245961D 00
2	0.8162276245961D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.48208310937[illegible]D 00	0.3443227031250D 00
2	0.34432270312[illegible]D 00	0.3691363593750D 00

CROSS PRODUCT MATRIX

1	0.7735481250000D 00	-0.5565718750000D-01
2	-0.5565718750000D-01	0.9180321250000D 00

C **********

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 4 7 17

THUS THE RESULTING NUMBER OF ITEMS IS 16

C **********

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

ITERATION 16

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.142792931346

WEIGHTED COVARIANCE MATRIX

1	0.4820831093750D 00	0.3934895512332D 00
2	0.3934895512332D 00	0.4820831093997D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.8859355815420D-01	0.0000000000000D 00	-0.7071067811976D 00	0.0000000000000D 00
			0.7071067811754D 00	0.0000000000000D 00
2	0.8755726606205D 00	0.0000000000000D 00	-0.7071067811754D 00	0.0000000000000D 00
			-0.7071067811976D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.964166218775

SUM OF DIAGONALS OF COVARIANCE MATRIX = 0.964166218775

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000031D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.8750491647281D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1213292167808D 01

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.1386541712984D 01

TABLE A-1 (Continued): J2/0758 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	0.849347935243	-1.199416716539	1.412161808807
2	1.177373792890	0.880939805924	-1.216472377723	1.380880248052
3	1.135151338690	0.873728365042	-1.212579101077	1.387821604051
4	1.144520471133	0.875346815669	-1.213452862109	1.386253814361
5	1.142404338600	0.874982163041	-1.213255995272	1.386606546418
6	1.142880440584	0.875064250755	-1.213300312376	1.386527116529
7	1.142773229666	0.875045768162	-1.213290334087	1.386544999394
8	1.142797367159	0.875049929455	-1.213292580665	1.386540973062
9	1.142791932596	0.875048992545	-1.213292074850	1.386541879583
10	1.142793156177	0.875049203489	-1.213292188733	1.386541675481
11	1.142792880690	0.875049155995	-1.213292163093	1.386541721434
12	1.142792942715	0.875049166688	-1.213292168866	1.386541711088
13	1.142792928750	0.875049164281	-1.213292167566	1.386541713417
14	1.142792931894	0.875049164823	-1.213292167859	1.386541712893
15	1.142792931186	0.875049164701	-1.213292167793	1.386541713011
16	1.142792931346	0.875049164728	-1.213292167808	1.386541712984

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 = 0. S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = 0.1386541712984D 01 S.D. OF POP. 2 = 0.1142792931310D 01

SLOPE = 0.8750491647281D 00 INTERCEPT = -0.1213292167808D 01

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 = 0. S.D. OF POP. 1 = 1.

MEAN OF POP. 2 = 0.1468885831893D 01 S.D. OF POP. 2 = 0.1253937346912D 01

SLOPE = 0. 974880104358D 00 INTERCEPT = -0.1171418839634D 01

TABLE A-1 (Continued):

For 51 Overlapping Items of Test J1, J1/1075 And J1/0614 Cases.

TITLE: SHIBA'S DATA
J1-1074 VS. J1-0614(TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.28444000D 02	0.55772549D 00	0.16950276D 02	0.33235835D 00	0.21300631D-01	0.14594736D 00
2	0.29880403D 02	0.58589026D 00	0.18849666D 02	0.36960130D 00	0.26333899D-01	0.16227723D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.8918349193782D 00
2	0.8918349193782D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.2130063052672D-01	0.2112215775133D-01
2	0.2112215775133D-01	0.2633389857026D-01

CROSS PRODUCT MATRIX

1	0.3323583529412D 00	0.3478880912473D 00
2	0.3478880912473D 00	0.3696012975106D 00

C **********

NOTE : THE FOLLOWING 4 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 51

C **********

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITERATION 6

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.948279922320

WEIGHTED CROSS-PRODUCT MATRIX

1	0.3323583529412D 00	0.3298952921442D 00
2	0.3298952921442D 00	0.3323583529404D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.6622536450850D 00	0.0000000000000D 00	0.7071067811870D 00	0.0000000000000D 00
			0.7071067811861D 00	0.0000000000000D 00
2	0.2463060796568D-02	0.0000000000000D 00	-0.7071067811861D 00	0.0000000000000D 00
			0.7071067811870D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.664716705882

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.664716705882

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999988D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1054540939296D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2254100442144D-02

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.054958746346	-0.002487122084
2	0.947904364473	1.054537820491	-0.002252361006
3	0.948282726867	1.054540962581	-0.002254113429
4	0.948279901382	1.054540939122	-0.002254100345
5	0.948279922478	1.054540939297	-0.002254100443
6	0.948279922320	1.054540939296	-0.002254100442

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.157370000D 02	-0.308568863D 00	0.458001210D 02	0.898041590D 00	0.802826990D 00	0.896006130D 00
2	-0.278642460D 02	-0.546357770D 00	0.475788830D 02	0.932919280D 00	0.634412470D 00	0.796500140D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000D 01	0.9762090248589D 00
2	0.9762090248589D 00	0.10000000000000D 01

COVARIANCE MATRIX

1	0.8028269903883D 00	0.6966901266655D 00
2	0.6966901266655D 00	0.6344124693203D 00

CROSS PRODUCT MATRIX

1	0.8980415882353D 00	0.8652789933303D 00
2	0.8652789933303D 00	0.9329192803139D 00

C **********

NOTE : THE FOLLOWING 4 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 51

C **********

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

ITERATION 7

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.124929037174

WEIGHTED COVARIANCE MATRIX

1	0.8028269903883D 00	0.7837269533981D 00
2	0.7837269533981D 00	0.8028269903489D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1586553943767D 01	0.0000000000000D 00	0.7071067811954D 00	0.0000000000000D 00
			0.7071067811777D 00	0.0000000000000D 00
2	0.1910003697046D-01	0.0000000000000D 00	-0.7071067811777D 00	0.0000000000000D 00
			0.7071067811954D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.605653980737

SUM OF DIAGONALS OF COVARIANCE MATRIX = 1.605653980737

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999749D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.8889449617972D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2720572415696D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.3060450908227D 00

TABLE A-1 (Continued): J1/1075 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	0.886410407510	-0.272839325507	0.307802484262
2	1.128145598841	0.889006821065	-0.272038153740	0.306002324497
3	1.124850761889	0.888943454293	-0.272057706738	0.306046133108
4	1.124930944900	0.888944998537	-0.272057230233	0.306045065421
5	1.124928990709	0.888944960902	-0.272057241846	0.306045091441
6	1.124929038334	0.888944961820	-0.272057241563	0.306045090807
7	1.124929037174	0.888944961797	-0.272057241570	0.306045090823

WHEN SCATTL ' DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF PUP. 2 =	0.30604509082270 00	S.D. OF POP. 2 =	0.1124929037202D 01
SLOPE =	0.8889449617972D 00	INTERCEPT =	-0.2720572415696D 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	0.2865059655582D 00	S.D. OF POP. 2 =	0.1089166526997D 01
SLOPE =	0.9181332470405D 00	INTERCEPT =	-0.2630506524545D 00

TABLE A-1 (Continued):

For 50 Overlapping Items of Test J1, J1/2259 And J1/0614 Cases

TITLE SHIBA'S DATA
J1-2259 VS. J1-0614(TEST)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.28065000D 02	0.56130000D 00	0.168066350D 02	0.33613270D 00	0.21075010D-01	0.145172350D 00
2	0.27877960D 02	0.55755919D 00	0.168182990D 02	0.33636598D 00	0.25493724D-01	0.15966754D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.8766880632215D 00
2	0.8766880632215D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.2107501000000D-01	0.2032102568093D-01
2	0.2032102568093D-01	0.2549372362347D-01

CROSS PRODUCT MATRIX

1	0.3361327000000D 00	0.3332790007617D 00
2	0.3332790007617D 00	0.3363659774213D 00

C **********

NOTE : THE FOLLOWING 5 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 30 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 50

C **********

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

ITERATION 5

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.999653178539

WEIGHTED CROSS-PRODUCT MATRIX

1	0.3361327000000D 00	0.3331634124516D 00
2	0.3331634124516D 00	0.3361327000015D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.29692875491340-02	0.0000000000000D 00	-0.7071067811873D 00	0.0000000000000D 00
			0.7071067811858D 00	0.0000000000000D 00
2	0.66929611245230 00	0.0000000000000D 00	-0.7071067811858D 00	0.0000000000000D 00
			-0.7071067811873D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.672265400001

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.672265400001

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000002D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.1000346941790D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.3935545338146D-02

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	1.000350034417	-0.003937281230
2	0.999650088064	1.000346914228	-0.003935529867
3	0.999653206080	1.000346942036	-0.003935545476
4	0.999653178291	1.000346941788	-0.003935545337
5	0.999653178539	1.000346941790	-0.003935545338

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.13932000D 02	-0.27864000D 00	0.42542096D 02	0.85084192D 00	0.77320167D 00	0.87931887D 00
2	-0.28417353D 02	-0.56834706D 00	0.53543449D 02	0.10708690D 01	0.74785060D 00	0.86478356D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000D 01	0.95223534540240D 00
2	0.95223534540240D 00	0.10000000000000D 01

COVARIANCE MATRIX

1	0.77320167040000D 00	0.72409927570670D 00
2	0.72409927570670D 00	0.74785060113390D 00

CROSS PRODUCT MATRIX

1	0.85084192000000D 00	0.88246350005180D 00
2	0.88246350005180D 00	0.10708689798950D 01

C **********

NOTE : THE FOLLOWING 5 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 20 30 34 53

THUS THE RESULTING NUMBER OF ITEMS IS 50

C **********

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

ITERATION 8

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.016808032255

WEIGHTED COVARIANCE MATRIX

1	0.7732016704000D 00	0.7362699596889D 00
2	0.7362699596889D 00	0.7732016704206D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.3693171072144D-01	0.0000000000000D 00	-0.7071067811915D 00	0.0000000000000D 00
			0.7071067811816D 00	0.0000000000000D 00
2	0.1509471630099D 01	0.0000000000000D 00	-0.7071067811816D 00	0.0000000000000D 00
			-0.7071067811915D 00	0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.546403340821

SUM OF DIAGONALS OF COVARIANCE MATRIX = 1.546403340821

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.1000000000014D 01

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.9834698077630D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.2943130311382D 00

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.2992598540545D 00

TABLE A-1 (Continued): J1/2259 And J1/0614 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	0.982647960869	-0.294542030557	0.299743186050
2	1.017658449233	0.983511050148	-0.294301539360	0.299235620500
3	1.016765393586	0.983467739067	-0.294313607560	0.299261069650
4	1.016810171068	0.983469911529	-0.294313002225	0.299259793080
5	1.016807924957	0.983469802557	-0.294313032589	0.299259857113
6	1.016808037623	0.983469808023	-0.294313031066	0.299259853902
7	1.016808031972	0.983469807749	-0.294313031142	0.299259854063
8	1.016808032255	0.983469807763	-0.294313031138	0.299259854055

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	0.29925985405450D 00	S.D. OF POP. 2 =	0.10168080322241D 01
SLOPE =	0.98346980776300D 00	INTERCEPT =	-0.29431303113820D 00

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	0.29456296083770D 00	S.D. OF POP. 2 =	0.10085439035760D 01
SLOPE =	0.99152847630560D 00	INTERCEPT =	-0.29206756373550D 00

TABLE A-1 (Continued):

For 52 Overlapping Items of Test J1, J1/2259 And J1/1075 Cases.

TITLE: SHIBA'S DATA
J1-2259 VS. J1-1074(TEST 1)

ITEM DISCRIMINATION PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	0.301372320 02	0.57956215D 00	0.18911201D 02	0.363676950 00	0.27784660D-01	0.16668731D 00
2	0.28477185D 02	0.54763817D 00	0.169997876D 02	0.32688223D 00	0.26974657D-01	0.16423963D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.1000000000000D 01	0.9452827655565D 00
2	0.9452827655565D 00	0.1000000000000D 01

COVARIANCE MATRIX

1	0.2778466027838D-01	0.2587868798142D-01
2	0.2587868798142D-01	0.2697465742219D-01

CROSS PRODUCT MATRIX

1	0.3636769492423D 00	0.3432690474184D 00
2	0.3432690474184D 00	0.3268822277158D 00

C **********

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 30 53

THUS THE RESULTING NUMBER OF ITEMS IS 52

C **********

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITERATION 5

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 1.054780842012

WEIGHTED CROSS-PRODUCT MATRIX

1	0.3636769492423D 00	0.3620736148727D 00
2	0.3620736148727D 00	0.3636769492274D 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.7257505641075D 00	0.0000000000000D 00	0.7071067811938D 00 0.7071067811793D 00	0.0000000000000D 00 0.0000000000000D 00
2	0.1603334362159D-02	0.0000000000000D 00	-0.7071067811793D 00 0.7071067811938D 00	0.0000000000000D 00 0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 0.727353898470

SUM OF DIAGONALS OF CROSS-PRODUCT MATRIX = 0.727353898470

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999794D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 2 TO THAT OF POPULATION TAKING TEST 1 = 0.9480642424941D 00

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.1823978764064D-02

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY AND INTERCEPT FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT
1	1.000000000000	0.947840578724	-0.001694351708
2	1.055029740704	0.948065233039	-0.001824552847
3	1.054779739991	0.948064238108	-0.001823976222
4	1.054780846914	0.948064242514	-0.001823978775
5	1.054780842012	0.948064242494	-0.001823978764

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITEM DIFFICULTY PARAMETERS

TEST	SUM OF PARAMETERS	MEAN OF PARAMETERS	SUM OF SQUARES	MEAN OF SQUARES	VARIANCE	STANDARD DEVIATION
1	-0.23045380D 02	-0.44318039D 00	0.48007492D 02	0.92322101D 00	0.72681215D 00	0.85253279D 00
2	-0.26333962D 02	-0.50642234D 00	0.55876272D 02	0.10745437D 01	0.81808010D 00	0.90447781D 00

PRODUCT MOMENT CORRELATION MATRIX

1	0.10000000000000D 01	0.96555024801050 00
2	0.9655502480105D 00	0.10000000000000D 01

COVARIANCE MATRIX

1	0.72681215176800 00	0.74453288375620 00
2	0.74453288375620 00	0.81808010043900 00

CROSS PRODUCT MATRIX

1	0.92322100799760 00	0.96896933281170 00
2	0.96896933281170 00	0.10745436868150 01

C **********

NOTE : THE FOLLOWING 3 ITEMS HAVE BEEN EXCLUDED FROM ALL COMPUTATIONS BECAUSE THE DIFFICULTY PARAMETER FOR ONE OR BOTH TESTS IS OUTSIDE OF THE INTERVAL FROM -2.00000 (BGMIN) TO 2.00000 (BGMAX) :

ITEMS 8 30 53

THUS THE RESULTING NUMBER OF ITEMS IS 52

C **********

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

ITERATION 8

WEIGHT ASSIGNED TO TEST 2 PARAMETERS = 0.942569050615

WEIGHTED COVARIANCE MATRIX

1	0.72681215176800 00	0.70177365339360 00
2	0.70177365339360 00	0.72681215176170 00

RESULTANT EIGENVALUES AND EIGENVECTORS (COMPLEX TYPE)

	EIGENVALUE		EIGENVECTOR	
	(REAL PART)	(IMAGINARY PART)	(REAL PART)	(IMAGINARY PART)
1	0.1428585805158D 01	0.0000000000000D 00	0.7071067811881D 00 0.7071067811850D 00	0.0000000000000D 00 0.0000000000000D 00
2	0.2503849837122D-01	0.0000000000000D 00	-0.7071067811850D 00 0.7071067811881D 00	0.0000000000000D 00 0.0000000000000D 00

IMSL SUBROUTINE IEGRF ERROR PARAMETER (IER) = 0

SUM OF EIGENVALUES = 1.453624303530

SUM OF DIAGONALS OF COVARIANCE MATRIX = 1.453624303530

ABSOLUTE DIFFERENCE BETWEEN THE SUM OF THE EIGENVALUES AND THE SUM OF THE DIAGONALS = 0.000000000000

RATIO OF SECOND ELEMENT TO FIRST ELEMENT OF EIGENVECTOR GIVEN BY MAJOR PRINCIPAL COMPONENT = 0.9999999999955D 00

ESTIMATE OF RATIO OF STANDARD DEVIATION OF ABILITY DISTRIBUTION
OF POPULATION TAKING TEST 1 TO THAT OF POPULATION TAKING TEST 2 = 0.1060930230356D 01

(THIS SLOPE IS COMPUTED BY DIVIDING THE RATIO OF THE SECOND ELEMENT
TO THE FIRST ELEMENT OF THE EIGENVECTOR BY THE ASSIGNED WEIGHT)

ESTIMATE OF INTERCEPT OF FITTED LINE FOR SCATTER
DIAGRAM OF TEST PARAMETERS OVER TEST 1 PARAMETERS = -0.3623886888928D-01

ESTIMATE OF MEAN OF ABILITY DISTRIBUTION OF POPULATION TAKING TEST 2
USING MEAN AND S.D. OF THAT OF POPULATION TAKING TEST 1 AS ORIGIN AND UNIT = 0.3415763624448D-01

TABLE A-1 (Continued): J2/2259 And J1/1075 Cases.

WEIGHT, RATIO OF S.D. OF ABILITY, INTERCEPT AND MEAN DISTANCE FOR EACH ITERATION

ITERATION	WEIGHT	S.D. RATIO (SLOPE)	INTERCEPT	MEAN DISTANCE
1	1.000000000000	1.063168686223	-0.035246829150	0.033152621598
2	0.940584512089	1.060850452017	-0.036274225085	0.034193533137
3	0.942639933931	1.060933076869	-0.036237607371	0.034156355533
4	0.942566521680	1.060930128796	-0.036238913899	0.034157681939
5	0.942569140849	1.060930233980	-0.036238867283	0.034157634614
6	0.942569047400	1.060930230227	-0.036238868947	0.034157636303
7	0.942569050734	1.060930230361	-0.036238868887	0.034157636242
8	0.942569050615	1.060930230356	-0.036238868889	0.034157636244

WHEN SCATTER DIAGRAM OF DIFFICULTY PARAMETERS IS SOLELY USED

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	0.34157636244448D-01	S.D. OF POP. 2 =	0.94256905061910 00
SLOPE =	0.10609302303560 01	INTERCEPT =	-0.36238868889280-01

WHEN TWO SCATTER DIAGRAMS ARE BOTH CONSIDERED TO ESTIMATE S.D. RATIO

MEAN OF POP. 1 =	0.	S.D. OF POP. 1 =	1.
MEAN OF POP. 2 =	0.35547058063740-01	S.D. OF POP. 2 =	0.94531265355620 00
SLOPE =	0.10578510678320 01	INTERCEPT =	-0.37603493331030-01

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